THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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OF THE OREGON COUNTRY
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PORTLAND, OR 97207

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Chairperson-Sue Barrett 639-4583

ACTIVITIES

ANNUAL EVENTS: President's Field Trip-summer. Picnic-August. Banquet-March. Annual Meeting - February,**FIELD TRIPS**: Usually one per month, via private car, caravan or chartered bus.**GEOLOGY SEMINARS**: Third Wednesday, except June, July, August. 8:00 p.m. Room S17 in Cramer Hall, PSU Library :Room S7, open 7:30 p.m. prior to evening meeting .**PROGRAMS:** Evenings: Second and Fourth Fridays each month, 8:00 p.m. Room 371. Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon **LUNCHEONS**: First and third Fridays each month, except holidays, at noon, Bank of California Tower, fourth floor, California Room, 707 SW Washington, Portland Oregon. **MEMBERSHIP:** per year from January 1: Individual, $15.00, Family $25.00, Junior (under 18) $6.00. Write secretary for membership applications.**PUBLICATIONS**: *THE GEOLOGICAL NEWSLETTER* (ISSN 0270 5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year (add $12.00 postage for foreign subscribers) Individual subscriptions at $13.00 a year. Single copies $1.00. Order from the Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207. **TRIP LOGS**: Write to same address for price list.

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VOLUME 61, NO. 1
JANUARY 1995

JANUARY ACTIVITIES

FRIDAY NIGHT LECTURES (Cramer Hall, PSU, Room 371, 8:00 p.m)

JAN. 13 Video Field Trip to the Keweenaw Peninsula. Introduced by Phil Johnson, GSOC member.

JAN. 27 Tsunami Hazards at Nicaragua and at Okushiri, Japan, by George Priest, Geologist, Oregon Department of Geology and Mineral Industries.

FRIDAY NOON MEETINGS (Bank of California Tower, 707 SW Washington, 4th floor. Lunch hour 11:00a.m. Program in California Room at 12:00 noon)

JAN. 6 Australia Safari II, by Mura Birdsall.

JAN. 20. Chasing Lava Flows in Washington State, by Evelyn Pratt.

GEOLOGY SEMINAR (Cramer Hall, PSU, Room S-17, 8:00 p.m.)

JAN. 18 Continuation of study of sedimentary, volcanic, volcaniclastic, igneous, and metamorphic rocks and their equivalents; will include studies of rock assemblages as indicators of geologic environments.

GSOC LIBRARY (Cramer Hall, PSU, Room S-7)
Open prior to Friday night meetings.

NOTICE

DUES ARE DUE - JAN. 1, 1995!
Individual -----$15
Family ---------$25
Jr. under 18 --- $6

COMPLETELY FRACTURED GEOLOGY

by Evelyn Pratt

1. **uraninite**: a question which elicits another question, "Why didn't you run in daylight?"
2. **spud in**: to plant potatoes
3. **sea floor spreading**: what is said during an earthquake, when things underfoot start moving apart
4. **seif**: not dangerous
5. **selenology**: the science of persuading people to buy things
6. **dip slip fault**: (a) cause of wrong answers when checking a car's oil; (b) when a fashion petticoat hangs below her skirt
7. **OWL lineament**: medicine for birds with sore flight muscles
8. **summit concordance**: for once, world superpowers agree on something
9. **flute cast**: a splint for a broken woodwind instrument
10. **core complex**: a psychological condition brought about by too many partly-eaten apples

CORRECT DEFINITIONS ON PAGE 80

THIS IS THE LAST OF THE REPORTS ON THE 1994 PRESIDENT' FIELD TRIP

BAKER TERRANE

by Helen Nelson

Today, Thursday, September 15, we go to Sumpter, some 30 miles south of Baker City. Load at 9:30 and nose through the city itself on Highway 7. Baker's City first post office established 1866 was the headquarters for nearby mines. The first area mine opened in Auburn, 8 miles west. Political minded Packwood was one of it's founders. The postoffice was opened in 1862. We passed by many buildings on the historical records, but not near the river where two of my grandchildren were born in 1958 - 60. The city is on a flat table-like surface, of a graben, a block dropped down, with faults on each side. It is about 10 miles long, entirely ringed by ridges , Elkhorn Ridge to the west is the highest. Why the valley is table top flat, I didn't ask. Loo' like it was shaped by water deposited sediments in a lake bottom.

The dredge, City of Sumpter, now boarded up, because accident insurance is too costly to open as a tourist attraction, was our first stop. The narrow gauge Sumpter R.R. manned by volunteers from Baker, was not operating. It regularity takes passengers through miles of the Sumpter dredge mounds of water-rounded rocks.

We visited the BLM Interpretive Center and walked warily around the three story or more high dredge. We could see the series of monster buckets, supported by massive steel frames poking out from one end. These buckets dipped up the stream bed gravels and rocks, screening out the larger rocks, retaining the smaller gold bearing ones. It dug a pool deep enough to float itself on. The buckets pulled the rocks, building a dike to form the pool. It built a series of pools in the stream. The Sumpter Dredge operated from 1913 to 1954.

An electrician I knew once was employed on the dredge in the area. You can see the walls of water powered electric plant that was built to supply electricity to the mines. Winter snows and outdoor toilets were a hardship for his family.

Lunch was at tables under trees in a beautiful park beside a lake. At Baker we were taken to see the city business district. We spent the remaining afternoon in Flagstaff Hill Oregon Trail Interpretive Center. Flagstaff hill was a steep, rocky and dusty road to climb according to the emigrants. The ruts of the original trail are visible in the grass.

Inside, the large building, life-sized characters, dressed in emigrant costumes, stood beside authentic wagons and horses. The animals, horses, cows, dogs, and cattle seems to have been prepared by taxidermists. All stood about two feet above the walkway against, diaroma effect, painte' backgrounds. The diaroma effect was continuou without walls. We walked in front of them, or stopped to listen to excerpts from diaries. We were to learn about the Baker Terrane. Ellen explained was formed on the ocean floor and rafted from the South Pacific and docked by the action of Plate Tectonics onto the growing North American Continent. Terrane: somewhat similar, separated from adjacent rocks by faults. Baker: serpentinite, and pyroxene

MEMORIAL BOOKS GIFT TO GSOC LIBRARY

The following two books given by Lillian Hoy in memory of Francis Rusche have been added to the GSOC Library.

1. **GEOLOGISTS AND IDEAS----A HISTORY OF NORTH AMERICAN GEOLOGY**, edited by Ellen Drake and William M..Jordon, and published as Centennial Special Volume I by the Geological Society of America in celebration of its 100th birthday.

This 525-page books comprises 33 chapters written by as many different authors and organized into four sections: "Evolution of Significant Ideas," "Contributions by Individuals," Contributions by Organizations," and ending with "Application of Significant Ideas." The variety of subjects and numerous illustrations (including many old photos from historical archives) make for a lot of interesting reading.

2. **PALEONTOLOGY OF THE DINOSAURS**, edited by James O. Farlow and published by the Geological Society of America as Special Paper 238. It is the outcome of a 1987 symposium in which a group of paleontologists, physiologists, and ecologists met to present their interpretations of the paleobiology of dinosaurs and other Mesozoic reptiles. Taking the view of dinosaurs as living animals, the authors came up with very different, and sometimes controversial, interpretations of what dinosaur life style was like.

Margaret L. Steere

EARTH BOOK IN GSOC LIBRARY

THE PLANET EARTH, a book donated to the GSOC Library by Kenneth Phillips, was published in 1986 to accompany the television series on the Earth. This 370-page book , written in popular style, is beautifully illustrated in color. Its author, Johathan Weiner, has compiled an informative and fascinating story about the Earth from various aspects under the headings: The Living Earth, the Blue Planet, the Climate Puzzle, the Solar Sea, Gifts from the Earth, and Fate of the Earth. Anyone feeling uncertain about the meaning of "plate tectonics" has only to read the chapter on The Living Earth to feel at home with the subject. Other chapters are equally revealing on subjects like ocean rings, El Nino, Meteor Crater the sun-spot cycle, black smokers and mineral deposits. A bibliography and index are included. (The editing marks in the text are suggestions Ken Phillips sent to the author in event of a new edition.)

Margaret L. Steere

FOSSIL BOOK ADDED TO GSOC LIBRARY

FOSSIL SHELLS FROM OREGON BEACH CLIFFS, by Ellen J. Moore, published by Chintimini Press, Corvallis, has been added to the GSOC Library. This popular booklet is the perfect companion to have when looking for fossils along the beaches in the Newport area. The fossils are well illustrated and the descriptions are easy to follow. In addition, the geologic formations of the area are explained and illustrated, and special attention is given to various sites of unique geologic interest.Ellen Moore's booklet is for sale at many shops along the Oregon coast and in bookstores elsewhere.

Margaret L. Steere

The following article is published in this publication with the permission of the author, Wes Wehr, paleobotanist at the Burke Museum (University of Washington, Seattle, Washington) and Washington Geology. The full article in Washington Geology ,Vol . 22, No.3, September 1994 , is titled "The Eocene Orchards and Garden of Republic, Washington." The full article is authored by Wesley C. Wehr and Donald Q. Hopkins.

BOTANICAL SALMAGUNDI

ARK Note: The Northeast corner of our state(Washington) has become a unique Botanical Eldorado. This area around Republic has been yielding a rich harvest of fossils, especially plants of the early Tertiary. Wes Wehr, paleobotanist at the Burke Museum (University of Washington, Seattle) has been in the thick of it all - not only in the field of exploration and collecting the fossils but in working up the collectings - identifying the fossil plants and linking them to their modern relatives. Articles on the subject appeared in " Douglasia", Summer 1993 and Winter 1994. What follows is a facinating account of the kinship of modern plants to their ancient ancestors.

The Eocene Orchards and Gardens of Republic

Wesley C. Wehr and Donald Q. Hopkins
Thomas Burke Memorial Museum
University of Washington
Seattle WA 98195

Washington state leads the nation in the production of several kinds of fruits and berries: apples, cherries, and red raspberries. The state's climate allows us to grow a wide variety of ornamental trees an shrubs (rhododendron, dogwood, mountain ash, holly, honeysuckle, juniper, laurel) and herbs (thyme). And the timber industry (fir, pine, cedar) is an important element of our economy.

What few people realize is that a great many of the plants we choose to cultivate were here about 50 million years ago - albeit looking a little different. The fossil beds at Republic and across the border to the north in British Columbia continue to show us that Washington's agricultural economy firml rooted in this region's geologic past. For that reason we have nicknamed the Okanogan Highlands, and the Republic fossil beds in particular, the Eocene orchards and gardens of the Northwest.

The botanical heritage of the Okanogan Highlands has made some significant paleontological contributions. The presence during the middle Eocene of more than 400 fossil species of plants is a record of diversity unmatched by any other known fossil locality in western North America. Near 250 species have been identified from Republic and Princeton, BC, and an additional 150+ taxa that likely represent new species and new genera have also been found in thes localities. Many of these fossils are on display at the Republic Stonerose Interpretive Center, Thomas Burke Memorial Museum, and the Princeton Museum and Archives.

Additionally, the world's oldest well-documented fossil records for our economic staples, apple (*Malus*), cherry (*Prunus*) and red raspberry (*Rubus*), come from Republic and Princeton. Oth fossil leaves and fruits - wild currant ana gooseberries (*Ribes*), mulberries (*Morus),* elderberries *Sambucus*) hazelnuts (*Corylus*), Saskatoon berry and serviceberry (*Amelanchier*. and the citrus familv (*Rutaceae*) also represent the oldest fossil records for these genera

Some Fundamentals of Paleobotany

The study of fossil plants depends primarily upon accurate radiometric dates for associated volcanic rocks and strata and competent identifications of well-preserved fossil material. Recent Ar^{40} - AR^{39} dating of the Klondike Mountain Formation, in which the Republic fossil flora occurs, has provided new information about the age of the flora and its closely associated volcanic rocks:

"Adularia in the Golden Promise vein, which marks the termination of Sanpoil volcanism in the district,is 50.1 + 0.1 Ma and a feeder di for the basalt on top of Klondike Mountain is 48.8

+ I Ma These dates limit the deposition of the Klondike Mountain Formation in the district to 'etween 50 and ≅49 Ma" **Bryon Berger**, US Geological Survey, written communication, 1992.) This age is essentially consistent with and confirms earlier estimations of the age of the Republic and coeval British Columbia floras.

Many of the Republic fossil leaves and plants are superbly preserved. This allows paleobotanists to compare them in microscopically fine detail with modern leaves of close affinty. However, some earlier identifications of fossil leaves were made from poorly preserved material that had only a superficial resemblance to the modern plants to which they were compared.

Some of these fossil plants were assigned not only to the wrong species and genera but to the wrong families and even orders as well. This would be analogous to identifying a fossil fly as a bee, or a fossil butterfly as a wasp. Paleobotanical literature abounds with theories about origins, evolution, and biogeographical dispersals of plant lineages that were based on such misidentifications. "Gross picture-matching", a common approach to fossil leaf identification in the not too distant past, was often oivious to these crucial differences between vegetational and floristic diagnostic features. As a consequence, many fossil leaf identifications now need critical review.

When identifying fossil leaves, it is essential to distinguish between certain kinds of features. For example, leaf shape and size and the character of the leaf margins (tooth or entire) [smooth] and tips (long and sharp drip tips or blunt tips) are features that can merely reflect a plants responses to climatic changes and environmental stress. Other leaf features, such as venation and tooth type, are not influenced by environmental factors; they indicate phylogenetic relations. These latter morphological characteristics superficial resemblances between fossil leaves from those that are phylogenetically diagnostic.

For instance, the willow family (*Salicaceae*) consists two genera: *Salix* (willow) and *Populus* (cottonwood aspen). Superficially, willow leaves and cottonwood don't look at all alike. Cottonwood leaves look more like Katsura leaves than they look like willow leaves. Willow leaves can look more like some forms of extinct oak family (*Dryophyllum*-for instance) than like cottonwood- aspen leaves. This is exactly where leaf architecture comes in. What *Populus* and *Salix* have in common, besides similar vein patterns, is that they both have a highly characteristic diagnostic type of leaf tooth (termed salicoid) that indicates their close phylogenetic relation. But only in well preserved fossil material can scientists discern clearly these critical diagnostic features.

The beautiful preservation of many Republic fossils leaves especially the examples of the rose family, and the application of leaf architectural criteria to distinguish between vegetational and phylogenetic features, has recently led recognition that many middle Eocene flowering (angiosperm) genera actually represent extinct ancestral genera. This would indicate that the middle Eocene warm temperate to subtropical climates in the Okanogan Highlands forests, thought to be a result of higher altitudes those in the coeval coastal lowland forests, were significant influences in the rapid evolution and diversification of groups of plants, especially the rose family group.

The Origins of the Rose Family

The rose family has many Eocene representatives in the Okanogan floras. This diverse family offers some challenges to paleobotanists because the origins of the Rosaceae are difficult to establish. There appear to be several valid occurrences of the family in the Paleocene of Alberta, notably *Spiraea* and a precursor of *Prunus*. Other reliable early records of the Rosaceae include *Vauquelinia* in the middle Eocene of Chalk Bluffs flora of Nevada and *Prunus* fossil wood and leaves from the middle Eocene of Wyoming.

The Okanogan Highlands fossil floras at Republic and Princeton, however, record the first major appearance of the Rosaceae, represented by genera of all four of its subfamilies.

At least 50 species of *Rosaceae* occur in these montane assemblages, represented by 20 identified genera, 36 identified species, and at least 16 rosaceous plants that have yet to be classified.

The most complete and well-documented record of *Prunus*, for example, occurs in this region: fossil leaves of five species of *Prunus* and the leaves of an extinct genus of primitive cherry have been found at Republic. More significant cherts at Princeton contain-in close association-fossil *Prunus* fruits seeds, and wood, and the Princeton One Mile Creek flora contains leaves of three species of *Prunus.*

Even though the rose family was obviously undergoing major diversification in the middle Eocene, fossil evidence for the presence in the Okanogan Highlands of several rosaceous genera (for example, *Malus, Rubus, Amelanchier, Neviusia, Hesperomeles, and Physocarpus*) typically consists only of rare leaves. Other rosaceous genera especially Prunus and extinct precursors of *Sorbus, Spiraea, and Crataegus*) are more common in the Republic and 'Princeton fossil deposits.

Because many rosaceous genera are closely related, they can be difficult to differentiate in fossil form, especially when only the fossil leaves are available. Hybrids at the genus level (termed bigeneric hybrids) occur both naturally and as cultivars today. Similarly, some of the middle Eocene rosaeous leaves, such as "*Crataegus/Pyrus*" in the Republic flora, suggest intergeneric affinities. Modern botanical idenifications are routinely based on complete plants. In conrast, many fossil identifications are based on isolated plant elements, typically leaves and wood, simply because that is all that is available for study. The presence in the Republic and Princeton floras of *Prunus* leaves, fruits, seeds, and wood provides a much better basis for attempting reconstruct the original entire plants and thereby their relations to ther similar forms.

Especially important among the early well-documented Rosaceae is a *Paleorosa* blossom from the Princeton cherts. This flower from an extinct genus is unique in the fossil record, not only for the remarkable anatomical detail preserved, but also because it contains the earliest known fossil rosaceous pollen preserved in a rosaceous flower. The Rosaceae, with the exception of *Sanguisorba,* are pollinated by insects, not by wind. The flowers have only small amounts of pollen, and rose pollen is indeed sparsely represented in the fossil records.

CORRECT DEFINITIONS (adapted from Dictionary of Geological Terms, 3rd Ed.; Bates & Jackson; AGI 1992)

1. **uraninite**: uranium dioxide, the chief ore of uranium
2. **spud in**: to start drilling a well
3. **sea floor spreading**: separation of parts of ocean crust by magma welling up along a midocean ridge
4. **seif:** in the Sahara Desert, a sharp-crested sand dune up to 200 m high and 100 km long
5. **selenology**: the science of the moon, including lunar geology
6. **dip slip fault:** a fault in which the movement is parallel to the direction in which the fault dips
7. **OWL lineament**: a topographic line stretching from the Olympic Mts. to the Wallowas; it is believed to reflect structure in the crust
8. **summit concordance**: nearly equal elevations of ridgetops or mountaintops over a broad area
9. **flute cast:** a raised oblong bulge on the underside of sandstone or siltstone, where turbulent water scoured a muddy bottom producing a groove which later filled in
10. **core complex**: in the central part of a folded structure, a large assemblage of different rocks so intricately involved that they cannot be separately mapped

YOU GOT TO BE KIDDING

Attempting to invent a joke at one of his rock group lectures, a speaker said that a sure way to find fractures in a slab was to drop it flat on the floor. He was surprised that no one laughed but the real shocker came with the letters he got. " I don't like you method, my slabs break in good areas too." Another said, "it works real good for everything by jade, I have to drop it two or three times." He decided to leave the country and take up a new hobby when this one came along. " I'm giving up on obsidian, it fractures in very direction that you ca see until you drop it on cement.

FEB 95

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Volunteer Speakers Bureau
Bob Richmond 282-3817

Annual Banquet
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Co-chair - Lois Sato 654-7671

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VOLUME 61, No. 2
FEBRUARY 1995

FEBRUARY ACTIVITIES

FRIDAY NIGHT LECTURES: (Cramer Hall, PSU, Room 371, 8:00 p.m.)

Feb. 10 "Arches National Monument, Fractured Fairy Tales," by Kenneth Cruikshank, structural geologist, associate professor at PSU.

Feb. 24 To Be Announced

FRIDAY NOON MEETINGS: (Bank of California Tower, 707 SW Washington Street, 4th Floor, Lunch/Social Time 11:00 a.m., Program in California Room at 12:00 Noon.

Feb. 3 "Stones of the Bible" by Mrs. La Verne Williams, member of the Tualatin Valley Gem Club.

Feb. 17 "Geologic Wonders of the Pacific Northwest" by Don Barr, past President, GSOC.

GEOLOGY SEMINAR: Cramer Hall, PSU, Room S-17, 8:00 p.m..
Feb. 15 "Eocene of the Northwest" by Richard Bartels.

GSOC LIBRARY : Cramer Hall, PSU, Room S-07. Open prior to evening meetings.

ANNUAL BANQUET: Friday, March 10 , 5 -9 p.m., at Grand Ballroom, third floor, Smith Memorial Center, Portland State University. Complete information is contained in the Newsletter. SEE NEXT PAGE

ANNUAL MEETING: FEBRUARY 24 . All chairpersons should have their committee reports ready to hand to the President at this Business Meeting.

FIELD TRIPS: March 25 COLUMBIA RIVER GORGE. This trip will be led by Evelyn Pratt. More information in the March Newsletter.

DUES ARE DUE------DUES ARE DUE------------- DUES ARE DUE--

I resigned as Editor of the Newsletter. I want to express my appreciation to those who have have written articles and sent in material for publication in the Newsletter. Also I want to thank the many GSOC members that indicated appreciation on the format of the Newsletter and for the varied subjects contained in this publication.

60th ANNUAL BANQUET NOTICE

PLACE: Grand Ballroom, third floor, Smith Memorial Center, Portland State University

DATE: March 10, 1995. **PUT A MARK ON YOUR CALENDAR!!!!!!!!!!**

TIME: 5:30 p.m. Grand Ballroom open for viewing exhibits and purchasing items from the sales table. Dinner at 6:30 p.m. sharp.

CHAIRPERSON: Evelyn Pratt, Lois Sato

SPEAKER: **Professor Ansel Johnsson,** Portland State University Geology Department. His lecture is entitled **" Earthquake Prediction in the Greater Portland Area".**

TICKETS: Ticket chairpersons, Freda and Virgil Scott, 8012 SE Ramona Street, Portland, OR 97207. Send a stamped, self-addressed envelope for the return tickets. Tickets will be available at all GSOC meetings. **PLEASE PURCHASE YOUR TICKETS EARLY.** It will help the Banquet Committee and you will have a better choice of table spaces.

PRICE: Cost of the banquet tickets is $13.00 each. Bring tickets to the banquet: they will be collected at the table.

PARKING: The 5th floor of the parking structure NO. 1, 1872 SW Broadway, between SW Harrison and SW Hall Streets, has been reserved from 5:30 p.m. for GSOC members attending the banquet. BE SURE TO PARK ON THE FIFTH FLOOR!!!!!!!!!!!!!. **READ ON**--- if you'r coming early to work on the banquet or you'r setting up an exhibit you must call Rosemary Kenney at 2210757 so your name is on a list at the check station at the entrance to the parking structure. Do not park in spaces marked "Reserved" or "Handicapped". From the 5 th. floor of the parking garage, a short stairway leads to a foot-bridge across Broadway to the level of the Banquet rooms.

BANQUET SALES TABLE NEEDS GOOD MATERIAL

Proceeds from the sales table at the Annual Banquet go to help meet expenses of the banquet. Please bring **EYE CATCHING AND SALABLE** material that will attract purchasers and be treasured by them. No large, heavy specimens, please. Limit your material to hand specimens or smaller. Suggested materials: minerals, slices of agate, crystals, fossils, thundereggs, tumbled agates, geodes, worthwhile books on geology , natural history and jewelry. If you need help in transporting your material to the building, phone Archie Strong at 244-1488 or Harold and Patricia Moore at 245-0135.

PROVIDE A BANQUET EXHIBIT

Displays for the Annual Banquet on March 10 are eagerly solicited. Exhibits of rocks, minerals, books, pictures or any hobby related to geology are suitable. Please call **Charlene Holzwarth at 284-3444** so space can be reserved. If possible, bring your own lamps and extension cords. The Exhibit Room will be open for setting up your material by 3:30 p.m. in the afternoon of the banquet. If coming to set up before 5:30 p.m. you must call **ROSEMARY** KENNEY at 221-0757 as your name must be on a list at the entrance to the parking structure. **No one gets to park early unless his or her name is on the list**

COMPLETELY FRACTURED GEOLOGY

by Evelyn Pratt

1. miscibility: a talented beauty queen
2. backarc: a painful spine
3. biotite: Part of an admonition to female shoppers: "If you want to be comfortable, don't biotite girdle!"
4. fluvial: meat from a calf that had respiratory problems
5. fluorescence: the smell of new linoleum
6. Gabbro: Swedish actress who said, "Ay vant to be alone
7. Hiatus: part of a Cockney answer to a question about lunch: " Hiatusardine sandwich, luv!"
8. Jolly balance: Santa's happy because his check book's up-to-date
9. Kinetic: the top floor of your relative's house
10. Lamalla: a sheep's knee cap

EXPANDED OUTDOOR RECREATION INFORMATION CENTER TO OPEN

The Nature of the Northwest Information Center, erated jointly by the State of Oregon natural resource agencies and the USDA Forest Service, will open on December 1 1994, on the first floor of the State of Oregon Office Building at 800 NE Oregon Street in Portland. Hours of the new center will be 8:30 a.m. to 5:00 p.m

The phone number will be 503-872-2750, and fax number will be 503-731-4066.

The new Nature of the Northwest Information Center will replace the Nature of Oregon Information Center, which has been operating at 800 NE Oregon Street since 1992 and which until December 5 will continue its operations from 10:00 a.m. until 5:00 p.m. on weekdays

Quake Shakes Thermal Lakes

by D. Love and S. Welch

This year in Yellowstone National Park, scientists e had a renewed opportunity to study the relationship between seismic events and the behavior of geysers. **Geysers**, or hot springs that erupt on an intermittent basis, are supplied with steam or hot water from reservoirs inside the rock.

These reservoirs consist of a **plumbing** system of fractures in the rock that convey hot ground water to geysers and hot springs. Changes in this plumbing, either by opening or closing of fractures, can change the flow of water to the geysers, affecting their eruption patterns. Earthquakes, such as the March 26, 1994 quake that rattled the Norris Geyser Basin in Yellowstone, can disturb the plumbing under geysers, resulting in changes in water temperatures and levels, and in the magnitudes and frequencies of geyser eruptions.

After the March earthquake, measuring 4.6 on the Richter scale, several geysers in the park have altered their behavior. Monarch Geyser, which had been sleeping for 81 years, woke up grumpy and threw rocks, mud, and water 15 feet into the air about once a day. In the early part of the century, before its dormancy, Monarch would shoot water up to 200 feet skyward, higher than most Old Faithful eruptions.

Following the same quake, Ledge Geyser erupted after a 15 year period of dormancy. In contrast, Steamboat Geyser, the largest geyser in the world, which sometime erupts to the height of 400 feet, showed signs of reduced activity, and perhaps is heading for dormancy. Changes in geyser eruption patterns are common following an earthquake, and serve to illustrate that Yellowstone Park's geyser regions are a dynamic and complex weave of thermal and geologic processes.

A few scientists speculate that some geysers change their pattern of eruptions before earthquakes occur. If so, it might be possible to predict earthquakes using geyser behavior. This hypothesis is being tested by detailed monitoring of eruption behavior of a few geysers in Yellowstone. The outcome of the data collection awaits more earthquakes. The evidence from previous observations, however, is that the most noticeable changes in geyser behavior begin with earthquake shaking and changes in natural plumbing.

The known **geothermal** areas in New Mexico may be affected by earthquakes as well. Although there are presently no geysers in the Jemez Mountains or the Lightning Dock geothermal areas, changes in amounts and temperatures of water from hot springs and hot wells are documented in both areas and the water is hot enough to flash into eruption-causing steam under the right conditions. Earthquakes could change the plumbing systems to the geothermal fields. Hot water moving to the surface along a number of faults in Jemez Canyon has shifted through geologic time to its present location at Soda Dam. Remnants of previous travertine spring deposits along the canyon walls show where plumbing systems used to be active.

Sources Elston, W. E., Deal E. G., and Logsdon, M.J., 1983, Geology and geothermal waters of Lilghtnmg Dock region, Animas Valley, and Pyramid Mountains, Hidalgo county, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Circular 177, 44 pp.

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Milstein, M., "Large Geyser goes to sleep:: Billings Gazette, issue for May 3, 1994, Montana.

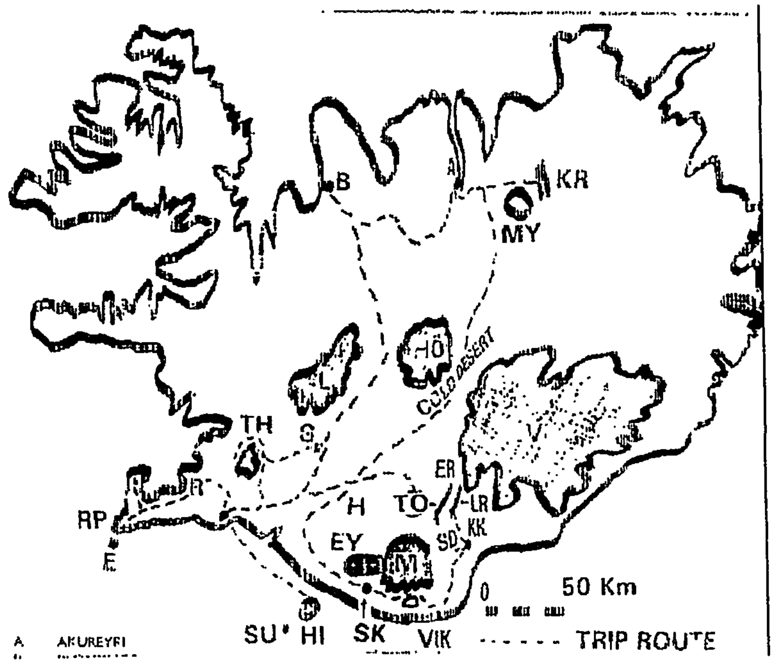
This article "Quakes Shakes Thermal Lake" appeared in LITE GEOLOGY, New Mexico Bureau of Mines and Mineral Resources, Summer ,1994. Articles in this publication LITE GEOLOGY may be be freely printed in other publication for public education.

THE 1993 GSA ICELAND GEOTRIP

by John H. Whitmer, M.D.
22533 S.E. 42nd Court
Issaquah, WA 98027

I call myself a serious amateur geologist. Since 1951, I have studied the geology of the places where I lived and mountain ranges where I climbed. I have attended many meetings and field trips. It has been a wonderful privilege to be able to learn from professional geologists who share my love for the crust of the earth.

The 1993 GSA Iceland Geotrlp was an opportunity I could not miss. It exceeded my expectations in every way & provided a tremendous learning experience I will always remember with great satisfaction. In the first 15 days of August, we traveled 2550 km. (1585 mi.) in a four-wheel-drive bus. Our leaders, Haraldur Slgurdsson (University of Rhode Island), Haukur Johannessc (Icelandic Museum of Natural History) &: Gudrun Larsen (University of Iceland) organized a magnificent itinerary and revealed geology to us effectively. There were many surprises and it was wonderful to see the abundance of landforms of such recent origin that erosion and weather had scarcely affected them.



We began at Reykjannes, "The Steaming Peninsula," at the southwest corner of Iceland, where the Mid-Atlantic Ridge is uplifted above sea level by the effect of the Icelandic Hot Spot. We had lunch in a rift valley. Nearby were a feeder dike leading to a spatter cone, a lighthouse built on a subglacially erupted palagonite, a large tephra cone, the remnant of a phreatic crater dated 1226 AD and a small, partially submerged caldera. Offshore, to the south, was Eldey (Fire Island), the product of a submarine eruption in 1210 AD. The oldest rocks on the Peninsula are basalt erupted from shield volcanoes during the last interglacial period. Next oldest are hyaloclastics and pillow basalts erupted subglacially during the last ice glacial stage. The must abundant rocks are post-glacial basalt flows. In this area, it is possible to straddle a narrow rift and imagine that one is touching North America & Europe simultaneously.

The landscape east of Reykjavik is mountainous, consisting of flat-topped hyaloclastite ridges a thousand ꞉t or so above sea level (suggesting the thickness of the ꞉acier into which they erupted) separated by rift valleys filled with flood basalt. Here we saw the first of many rootless vents ("pseudocraters") where a large basalt flow covered surface water, giving rise to multiple explosions. The resulting small scoria cones remain intact -- pimples on the surface of the large flows. In places, they have been dissected by streams or bulldozers, revealing their structure. Similar structures are abundant in the Columbia River Basalt; but the tephra cones have been removed by erosion or buried by subsequent flows, leaving only the palagonite to mark their presence. Iceland is a marvelous place to see what the Columbia River Basalt flows looked like before partial destruction by erosion & burial by subsequent lava.

The fissures which gave rise to Iceland's two major historic flood basalt eruptions provide especially good examples. The Eldgja Fissure Eruption of 934 AD was 75 km. (47 mi.) long, partly subglacial & partly sub-aerial, producing flood basalts that flowed into the ocean. The fissure cuts straight across the older landscape, making grabens, one of which is 150 meters (492 ft) deep, 400 meters (1312 ft) wide &-8 km. (5 mi.) long, the 'ley of the "Unfordable Stream." Spatter cones in the floor of the fissure mark the sites of fire fountains which covered the hyaloclastite & tillite walls of the graben with a veneer of welded spatter 10 to 15 meters (33.-50 ft) thick. Frozen cascades of this welded spatter converge into floodbasalt on the valley floor. Pre-existing gullies in the garben walls were filled with welded spatter. One of them carries a stream which partially removed the welded spatter, leaving a natural bridge which endured from 934 to 1993 (It collapsed before we arrived.) Until I visited Eldgja, I could never have understood the role of fire fountains and welded spatter in the genesis of the Columbia River Basalts.

The next days visit to the site of the Laki Fissure Eruption of 1783 provided an opportunity to stand atop a large spatter cone and behold a graben filled with spatter coelescing into an immense flood basalt unit,.

Much later in the tour, we visited the Krafla Caldera where we walked upon the basalt flows which erupted from fissures between 1975 and 1984. Clouds of water vapor and H2S emanated from part of the flow. The Icelandic power authority began building the Krafla geothermal power station in 1974 -- a good time for logy, but a bad time for construction. Almost immediately, the engineers detected inflation, which preceded the eruption of 1975. They subsequently observed about 20 cycles of inflation and deflation, with intervening fissure eruptions.

Inflation occurred at the rate of 6 to 10 mm. (1/4 to 2/5 of an inch) daily, followed by sudden deflation as much as 60 cm (2 feet). Haraldur calls the Krafla Power Station "the most expensive tiltmeter in the world." Within sight of the power station is a crater about 85 meters (280 feet) wide marking the site where, in 1977, magma rose through the casing of an 1138 meter- (3734 feet) deep bore hole, blowing out the wellhead and blasting the crater.

Most of the volcanic center of Iceland are highlands, covered by ice caps called "jokulls" which conceal large, active calderas. Our leaders took us to a smaller caldera. Torfajokull, which was largely ice-free. Here we were surmised to find a large body of rhyolite. Within the caldera (diameter 18 km.) (11.2 miles) most of the rhyolite has erupted sub-g;lacially to produce silicic hyalocalstics and immense rhyolitic pillow structures. Outside the caldera, some large obsidian flows are several kilometers long. Other flows consist of mixed obsidian and basalt. These flows dwarfed the flows I have seen at Newberry Caldera and the Medicine Lake Highland. Haraldur, Haaukur and Sigurd demonstrated the relationship of this caldera to the major fissure system (Veidivotn) extending to the northeast. Basaltic dikes intruded laterally in the Veidivoyn fissures, invading the Torfajokull magma to generate the mixed basalt-rhyolite flows and the superheated, long rhyolite flows. Haraldur's research has shown as much as 60 kilometers (37 mi.) of horizontal basaltic dike intrusion in fissure zones such as Veidivotn and Krafla. In the course of a few miles travel northeast from Torfajokull we went from rhyolite to mixed rhyolite/basalt to basaltic explosion crater (the "Ugly Pool") to basaltic tephra cones.

Of course, our leaders took us to Heimacy, the center of a major submarine volcanic complex. Herein 1973 an eruption along a fissure 1.5 K,. (.93 mi. long, lasted 155 days, producing a new scoria cone 220 meter (722 feet) high, now called Eldfell, and partially burying the town of Vestmannaeyjar beneath basalt flow and tephra.

Eldfell still emits steam clouds and the smell of brimstone near its summit. To me, the experience of walking on basalt on 20 years old, yet it was blanketed by a 6 inch deep pile of moss was sensational.

Heimacy is about 9 km. (5.6 mi) off the southern coast of Iceland, but required a 65km. (39 mi) ferry ride (about 3 hours) to get there. Astonished to learn that there was insufficient water on the island to provide for the population, I asked why would people be so determined to live there that they would endure volcanic eruptions, attempt to divert a lava flow by pumping sea water on it, rebuild a partially buried town and construct two pipelines from the mainland to provide drinking water. The answers is that volcanoes degrade into good harbors as the sea breaches their craters, fissures and shattered central vent areas. The southern coast of Iceland, in contrast, is devoid of harbors because it is rapidly prograding owning to deposition by flood basalts such as Eldgja and Laki, by overloaded, glacier-fed streams, and by outburst floods consequent to subglacial eruptions of Katla (Myrdahlsjokull). Beyond the reach of this rapid sedimentation, Heimacy is the closest sea port to Iceland's richest fishing grounds.

Gudrun, a tephrachronologist, who is very proficient with shovel and very patient with people who have many questions, took us to many notable outcrops of tephra, showing us the layers which correlate with historic eruptions in Iceland. We visited the restored ruins of a Viking farm in the district north of Hekla which was abandoned after the eruption of 1104 AD eruption of Hekla. Hekla has erupted several times in this century (e.g. 1947-48, 1970, 1980, 1991). Its fluorine-rich tephra kills livestock (>7500 sheep in 1970) and has resulted in the abondonment of farms as recently as 1948.

The biggest surprise came to me was the Cold Desert, which we traversed to reach the northern coast of Iceland, A highland (maximum elevation of 1000m (3300 ft) between Hofsjokull and Vatnajokull (two immense icecaps), it was, in mid-August, reminiscent of the Red Desert of Wyoming in February -- bitter cold, with wind of near hurricane velocity. It was the most inhospitable place I have ever seen, and totally barren because the wind carried the soil away. Travel is slow because of the primitive, unpaved road, and we had to spend the night in a crude Icelandic tourist hut. The trip to the outhouse in the howling wind and zero (F.) or below temperature rivalled the worst conditions I encountered in Wyoming winter.

It was therefore a joyful experience to reach the northern edge of the highland and descend into the long, straight rift of the Bardardaladur to a lowland of flood basalt. glacial moraine, glacial lakebeds and ultimately to a large fjord (the Eyjafordur) and the beautiful city of Akureyri. Akureyri has an astounding botanic garden where many of the plants typical of Seattle or Portland thrive.

The oldest rocks in Iceland are flood basalts estimated about 16 million years age. They comprise the eastern and western edges of the island, dipping gently toward the rift axis in the center. A few sedimentary interbeds yield petrified wood and other remains of fir, walnut, elm magnolia, birch and hickory trees.

On the last day, we crossed the desolate highland between Langjokull and Hofjokull, where there was a magnificent panorama of distant icecaps, valley glaciers and glacial lakes, long parallel rift valleys, shield volcanoes, caldera, and hyaloclastic ridges.

Each participant received a copy of Sigurdsson, Johanneson and Larsen, ICELAND GEOLOGY: A FIELD GUIDE, a fine 48 page booklet filled with information about geology, history, culture and economy of Iceland.

Haraldur, Haukur, and Gudrun interpreted the landscape with great skill and clarity. They certainly enhanced my understanding of volcanoes, hot spots and rifts. Thanks to them, my photo archives are greatly enriched. There is a plethora of volcanic and glacial landforms. To borrow a sentence from my hero, J.Harlan Bretz, "They await your inspection in almost their pristine forms."

CORRECT DEFINITIONS (adapted from <u>Dictionary of Geological Terms</u>, 3rd Ed.; Bates & Jackson; AGI 1992)

1. miscibility: the ability of two or more phases to mix and form one phase
2. backarc: refers to basins and thrust faults located on the continental side of a range of subducting-plate-associated volcanoes such as the Cascades
3. biotite: a common dark-colored, rock-forming mica
4. fluvial: of or pertaining to rivers
5. fluorescence: the emission of visible light by a substance when it is exposed to ultraviolet light
6. gabbro: a dark-colored, basic igneous rock, the intrusive equivalent of basalt
7. hiatus: a break in the stratigraphic record where rocks that would normally be present in the sequence are absent
8. Jolly balance: a delicate spring balance used to measure the specific gravity of minerals
9. kinetic: having to do with movement
10. lamella: a thin scale or layer in a mineral or an organism

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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OF THE OREGON COUNTRY
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PORTLAND, OR 97207

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ACTIVITIES

ANNUAL EVENTS: President's Field Trip-summer. Picnic-August. Banquet-March. Annual Meeting - February,**FIELD TRIPS**: Usually one per month, via private car, caravan or chartered bus.**GEOLOGY SEMINARS**: Third Wednesday, except June, July, August. 8:00 p.m. Room S17 in Cramer Hall, PSU Library :Room S7, open 7:30 p.m. prior to evening meeting .**PROGRAMS:** Evenings: Second and Fourth Fridays each month, 8:00 p.m. Room 371. Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon **LUNCHEONS**: First and third Fridays each month, except holidays, at noon, Bank of California Tower, fourth floor, California Room, 707 SW Washington, Portland Oregon. **MEMBERSHIP:** per year from January 1: Individual, $15.00, Family $25.00, Junior (under 18) $6.00. Write secretary for membership applications.**PUBLICATIONS**: *THE GEOLOGICAL NEWSLETTER* (ISSN 0270 5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year (add $12.00 postage for foreign subscribers) Individual subscriptions at $13.00 a year. Single copies $1.00. Order from the Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207. **TRIP LOGS**: Write to same address for price list.

GEOLOGICAL NEWSLETTER

The Geological Society of the Oregon Country

P.O.Box 907 Portland, Oregon 97207

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VOLUME 61, No. 2
MARCH 1995

MARCH ACTIVITIES

FRIDAY NIGHT LECTURES : **(Cramer Hall. PSU, Room 371, 8:00 p.m.)**

March 10 **60th Annual Banquet**, 5:30 p.m., Grand Ballrrom, 3rd floor, Smith Memorial Center, Portland State University. Speaker: Dr.Ansel Johnson, Professor of Geophysics, Portland State University. Topic: "Earthquake Prediction in the Greater Portland Area." **CORRECTION ON PRICE OF BANQUET. THE COST IS $13.50 PER PERSON INSTEAD OF $13.00 PER PERSON.**

March 24 To be announced

FRIDAY LUNCHEONS: Bank of Californa Tower, 707 SW Washington, 4th floor. Social time in Cafeteria 11:30 a.m. Program in California Room at 12:00 noon.

March 3 To be announced

March 17 "Where will our water come from 5 years from now?" Speaker will be Lorna Stickel, Portland Water Bureau.

GEOLOGY SEMINAR: Cramer Hall, Portland State University, Room S-17, 8:00 p.m.
March 15 "The Eocene of the Northwest" by Richard Bartels.

GSOC LIBRARY: Cramer Hall, Portland State University, Room S-7. Open 7:00 p.m.- 8:00 p.m. prior to evening meeting.

FIELD TRIP: March 26 Sunday: "Looking at the Latest Information on the Columbia River Basalts," led by Evelyn Pratt. This trip will be members own transportation. Phone Evelyn Pratt at 223-2601 if you are going on this trip.
MEET AT THE PARKING LOT AT LEWIS AND CLARK STATE PARK, TROUTDALE AT 8:30 a.m. BRING LUNCH, RAIN GEAR AND OTHER NECESSITIES, ROCK, HAMMER MAY BE CONENIENT.

ALL ITEMS TO BE PRINTED ON THE CALENDAR OF ACTIVITIES OF *THE GEOLOGICAL NEWSLETTER* MUST BE SUBMITTED TO THE CALENDAR EDITOR BY THE 15th OF THE MONTH

IN MEMORIUM: MARGARET STEERE:

Margaret Steere, geologist and geologic editor with the Oregon Department of Geology and Mineral Industries (DOGAMI) for almost 30 years, died of pneumonia on January 29, 1995. A native of Muskegon, Michigan, Margaret received her bachelor's degree and master's degree in geology from the University of Michigan. She came to Oregon during World War II and worked as a cartographer in the U.S. Army Corps of Engineers. She joined DOGAMI staff in October 1947, working at first as a librarian and later as a geologist and geologic editor. She retired from DOGAMI in 1977 but returned in 1991 as a volunteer, donating 691 hours of volunteer service.

During her working year with DOGAMI, Margaret produced over 300 issues of the *Ore Bin* , DOGAMI's monthly publication, and edited almost 60 Bulletins, plus numerous other Short Papers, Miscellaneous Papers, Oil and Gas Investigations, geologic maps, and open files reports. Her knowledge of geology, ability to organize, mastery of language, sense of humor, and endless patience enabled her to bring these detailed publications to press, often under difficult circumstances. Although paleontology was not her original focus in geology, she became the resident expert because there was a need for paleontological knowledge in DOGAMI. Her articles on fossils were some of the most popular articles in the *Ore Bin.* Bulletin 92, *Fossils in Oregon,* which contain reprints of many of her articles, is still one of DOGAMI's most popular publications.

In addition to her work on publications, she had the responsibility for maintaining the DOGAMI museum and devoted many hours to curating the collection. Her work with publications, the museum collection, and paleontology put her in contact with many of the major geologists of her time. Correspondence found in her files shows the respect and appreciation that many of these geologist felt for her work.

Margaret was an active member of the Geological Society of the Oregon Country, often working behind the scenes to see that work that needed to be done was properly done. Her activities with the Society included working on the GEOLOGICAL NEWSLETTER with articles she wrote and helping to get the monthly publication ready for publicatio. She led many geologic and fossil field trips for the GSOCs. Her presence and contributions on the yearly President's Field trip was much appreciated. Margaret's help with all aspects and contributions to the Geological Society of the Oregon Country will be missed, but most of all she'll be missed because of the wonderful person she was.

Margaret developed considerable skill as a water colorist. When she returned to DOGAMI as a volunteer, she reorganized the photo file and brought it up to date and made an index of *Oregon Geology* articles from 1982 to the present. She then tackled learning to use the computer and entered over 700 titles of theses in the bibliographic database. Prior to her death , she was working on a way to enter data on site specific reports into DOGAMI's bibliographic database.

She was a friend of all at DOGAMI and the Geological Society of the Oregon Country and her skills, knowledge, quiet humor, and competency will be missed. She is survived by her nieces , Lois Beattie of Portland and Alice Coulombe of Pasadena, California, a nephew, several cousins and numerous friends.

At her request, remembrances may be sent to the Community Music Center in Portland or to The Geological Society of the Oregon Country Endowment for OMSI's Camp Hancock. The interest from the endowment will be used annually to purchase books, educational materials, and research and outdoor equipment for OMSI's Hancock Field Station (Camp Hancock). Donations to the Geological Society of the Oregon Country Endowment may be made in care of: care of:

The G.S.O.C.Endowment for OMSI's Camp Hancock
OMSI Development Office
1945 SE Water Ave.
Portland, OR 97214

Beverly Vogt of DOGAMI provided information on Margaret Steere's activities while working for DOGAMI..

Thee Board of Directors wishes to inform the membersship of the financial status of the Association. In 1993, our expenses were $1,007.49 more than income; in 1994, expenses were $939.36 morethan income. For 1995 anticipated income is $ 2,825.00 and with a minimum budget of $4000.00, expenses are projected to be $1,175.00 more than income

COMPLETELY FRACTURED GEOLOGY

by Eveyln Pratt, Past President, GSOC

1. **kaolin**: a stringed instrument invented by Kay
2. **mylonite**: Explaination for not going out after 6 p.m. "I've just paid all the bills and this is mylonite.
3. **Neogene**: a joint located between Gen's hip and his ankle.
4. **lapilli**: French medicine
5. **leucite**: in England, where the bathroom is
6. **matrix**: (a) several old Roman mothers; (b) pranks played in the springtime
7. **palagonite**: a best freind's miserable New Year's Eve
8. **sial**: a film director's instructions to romantic lead who isn't passionate enough: "Si, Al!"
9. **venifacts**: legal terminology; "The judge will decide the case venifacts are all in."
10. **torque**: referring to speech, as in "Your torque too much."

CORRECT DEFINITIONS FOR COMPLETELY FRACTURED GEOLOGY ON PAGE 18

CHASING LAVA FLOWS ACROSS WASHINGTON STATE

by Evelyn. Pratt, Past President, GSOC

In October the Geological Society of America held its annual convention in Seattle. As usual, various field trips were offered. I selected one which followed two large-volume Columbia River Basalt Group flows across southern Washington:

(1) a 16 1/2 Ma Grande Ronde Basalt Formation flow

(2) a 15 1/2 Ma Wanapum Basalt Formation flow

We used Beeson & Tolan's 1989 classification (currently being updated) which highlights four main Formations. From oldest to youngest they are the Imnaha, Grande Ronde, Wanapum, and Saddle Mts. Basalts. Each of these is divided into members or units, which are subdivided into "Basalts of . . .", which may then be split into individual flows.

Twenty to thirty years ago, one Columbia River Basalt formation was roughly distinguished from another by physical characteristics and by the ages of fossils in the rock or soil above and below each. Thanks to a lot of work by many geologists, much more is now known about the Columbia River Basalt Group's 300+ lava flows. Newer techniques have helped to decipher what areas particular flows came from. CRB's are tholeiitic, which means they contain more magnesium and iron silicates than most volcanic rocks. Each flow has its own combination of these and of other chemical compounds, which give it a unique "fingerprint" that can be traced for many miles. Calculation of ages has become more exact with the use of radioactive dating and of magnetic sequencing - finding out which direction iron particles in consecutive flows point, then comparing the sequence with known magnetic successions.

Columbia River flood basalts emerged as huge sheet flows, each with a relatively orderly and consistent arrangement of cooling joint patterns, vesiculated zones, etc. The surfaces of smaller non-flood flows such as those in central Oregon and in Hawaii are more irregular, and lava tubes maybe present, especially toward the outer edges of the flows. In the Columbia River Basalt Group some features of smaller flows can be found along flow edges and by vents.

Terry Tolan, Steve Reidel, and Marvin Beeson's familiarity with the CRBG made for a highly instructive and interesting three days. We were based in Richland, which sits on top of nearly three miles of basalt a few miles west of where the Snake River runs into the Columbia.

DAY 1: Joseph Creek Flow, Teepee Butte Member, Grande Ronde Basalt Formation

The first day we departed at 6:30 AM, drove east past Wallula Gap to Clarkston, then south to a tributary of the Grande Ronde. One of the oldest Grande Ronde Basalts originates in a 16.5 Ma vent where Joseph Creek lavas and tephra pushed up through Imnaha Basalt. (see map). The vent is across from the headquarters of a wildlife refuge. The ranger and his pack of beagles, which he keeps to track down nuisance bears and cougars, gave us a warm welcome. After lunch we climbed up past "stacked cordwood" dikes; scraped at pastel-colored tephra interbedded between dark pahoehoe lavas; and picked up "Pele's tears" - globs of black glass thumbnail-size and smaller - which had weathered out of hardened tephra. The latter usually disintegrate fairly quickly; Hawaiian geologists in the group were surprised to see them in a formation this old. High atop one vent rampart, curious mountain sheep took turns watching us. Shadows were lengthening as we scrambled down to the vans for the five-hour drive back.

DAY 2: Basalt of Ginkgo, Frenchman Springs Member, Wanapum Basalt Formation

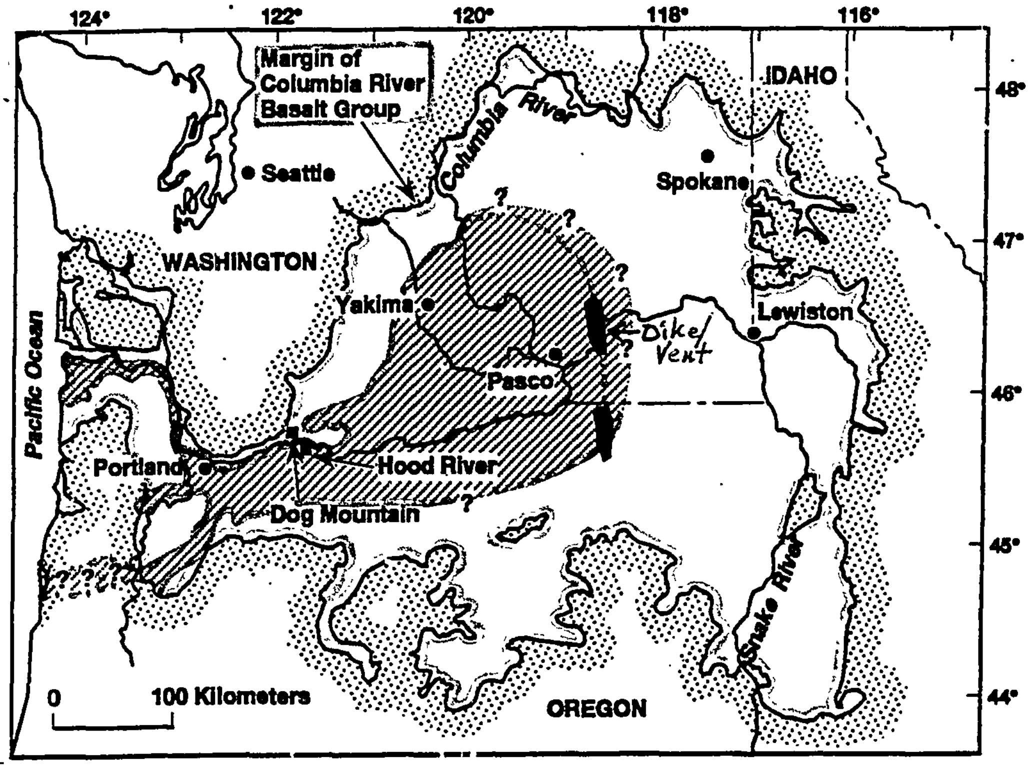
Next day we drove a relatively short distance north from Richland along the Snake River, where it has been dammed to form Lake Sacajawea. As we followed an abandoned railroad track on the west bank of the lake, we examined vents and dikes of 15.5 Ma Basalt of Gingko Member of the Wanapum Basalt, a million or so years younger than the Grande Ronde Joseph Creek flow we'd seen on Day 1. Here Grande Ronde Basalt was buried several feet beneath Wanapum Basalt. Flows of the latter commonly display both large columnar jointing and entablature/collonade jointing patterns. The basalt of Ginkgo typically shows big blocky columns. The flow below it, the basalt of Palouse Falls, has hackly entablature above and narrow-columned collonades below similar to what we see in the Columbia Gorge (especially along the old highway). Here and there between the two flows were chunks of red lava, probably rafted along as the Ginkgo flow covered the earlier basalt's entablature.

Basalt of Ginkgo forms very resistant dikes. In one place a major feeder dike had come up through both Grande Ronde Basalt and an ear[illegible] easily-weathered Wanapum flow. The dike w[illegible] double, and its twin rows of "stacked cordwood" made a standing wall. A freshly-broken piece of Ginkgo basalt is almost black, spotted with fingernail-sized globs of honey-colored plagioclase. This is true whether the rock comes from Pasco, from Vancouver, or from Oregon's Ecola Park.

The double dike rises up 200 feet to what would have been the surface 15.5 million years ago. We drove around and hiked to a spot about 100 feet directly above where we had been. Here the ascending dike had widened out to form a small gray lava pool, and had contacted water - a swamp or pond, perhaps. Where hot lava meets cold ground water, surrounding soil and rock can be steam-blasted into rubble, baked, and might undergo chemical change. Under less pressure pillow lavas may result. Here the fissure and the gray lava pool were lined with shattered breccia next to one-to-two-foot wide pillows. Higher up the whole dike widened to about 40 feet and fed into the main Ginkgo flow.

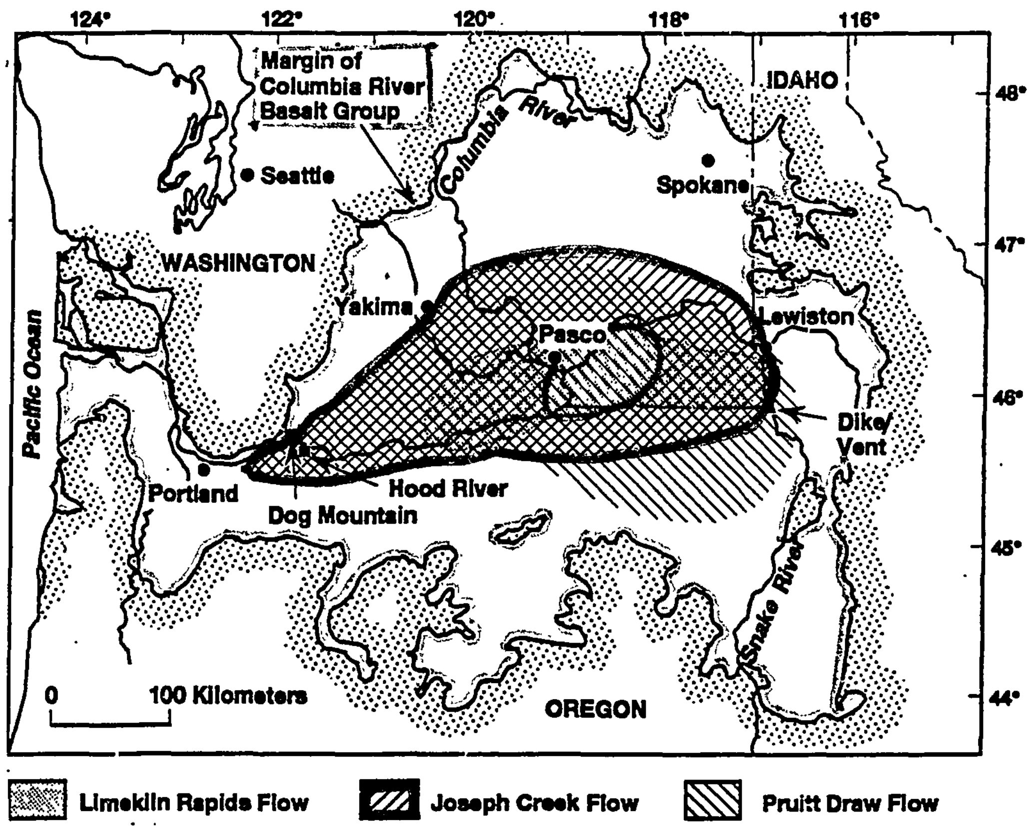
We ate lunch alongside the lake at apt[illegible] named Windust Park. From there we drove north and took pictures of one flow of basalt of Palouse Falls several hundred feet high, underlying the basalt of Ginkgo. Basalt of Palouse Falls had covered and baked a soil called the Vantage horizon. This horizon represents 200,000 years between earlier and later lava flows, during which soils formed and forests of ginkgo, cypress, and dawn redwood grew. Directly on top of the Vantage soil the Palouse Falls basalt consists of rusty blocky collonade. Above that is 100-200 feet of the flow's dark glassy entablature. Like the basalt of Ginkgo above it, the Palouse Falls flow can be followed for many miles without any appreciable change in appearance. The size of these two flows made it easier to imagine a subsiding basin beneath us accumulating nearly three miles of basalt.

On the west slope above Lower Monument Dam we found two features characteristic of non-flood lava flows and CRBG vents. When eruptio[illegible] start or end and are producing only small amounts lava, lobes may spread out horizontally from a vent.



15.6 Ma **BASALT OF GINKGO**, Frenchman Springs Member, Wanapum Basalt Formation

DAY 2



16.5-16.0 Ma **TEEPEE BUTTE MEMBER**, Grande Ronde Basalt Formation

DAY 1

Often holes and tubes are left inside them as still-molten lava drains away. Our group leaders call these lobes "pahoehoe toes." Some of the cavities are now lined with zeolites. Also, dips and hollows that had been on the surface 15.5 Ma were filled with pinhead- to fingernail-sized cylindrical shards of pale pastel-colored tephra. Unlike the outside, the interior of a freshly-broken shard is black, glassy, and filled with tiny vesicles. Scattered bits of rusty pumice in the tephra indicate that as lava emerged from fissures a few miles to the west, it erupted into fountains, and the resulting shards were blown here by wind. The tephra's upper few inches were covered by the main Ginkgo flow and fused into black glass.

On the way back we stopped at a monolith consisting of three members of Saddle Mts. Basalt Formation, youngest of the CRB Group. Some 14 to 10.5 Ma the ancestral Salmon-Clearwater River ran through here. At various times it was dammed by Saddle Mts. Basalt. Based on evidence at these medium-size intracanyon exposures, our leaders believe that it took only a few weeks or months for the flows to be emplaced.

DAY 3: Following Basalt of Ginkgo; End of Joseph Creek Flow

Day 3 took some of us from Richland to Portland and others to Seattle. Our two main stops before parting included one on a little-used road between Bickleton and the Columbia somewhat east of the Gorge. Here the Ginkgo flow is underneath older sediments (Ellensburg~The Dalles Formation). It was pointed out that the sedimentary structure had been disturbed; that small dikelets extend up from the lower flow into sediments above; that a glass top is on the Ginkgo where it had contacted overlying sediment; and that baked sand and silt are in the Ginkgo flow. It is inferred that red hot lava ran down a dry Columbia River channel and burrowed into and under its soft, mucky sand and silt. The Ginkgo shows its typical pattern of blocky to columnar jointing with no evidence of cavities or tubes, so it was probably part of a big sheet flow. In the Ellensburg Formation we dug out pieces of partly-fossilized wood, some looking as if freshly split.

Our last main stop was at Dog Mt. west of White Salmon, where close to 4000 feet of all four main units of Grand Ronde are exposed. Two days earlier, far to the east, we'd scrambled up to a vent of the Joseph Creek flow, Teepee Butte Memb Grande Ronde Basalt Formation. At Dog Mt., secondary minerals from Cascade hot springs fill cavities in the Teepee Butte. Otherwise its flows resemble their outcrops near the Idaho border. All three Teepee Butte flows including the Joseph Creek come to an end a bit west of Dog Mt. We'd followed the Joseph Creek flow from its beginning almost to its end.

But the basalt of Ginkgo, which we'd traced emerging from vents north of Pasco, goes on. Its course can be followed below Cape Horn, through Vancouver and Portland, down the lower Columbia River valley and several miles out to sea. Nothing in our modern world can compare with the volume and distance covered by these ancient lava flows.

CORRECT DEFDINITIONS (adapted from Dictionary of Geological Terms, 3rd Ed.: Bates and Jackson; AGI 1992)

1. **kaolin**: a group of clay minerals with two-layered crystal structure, used in making ceramics and heat-resistant materials
2. **mylonite**: a cherty rock with steaked or banded structure, produced by stong metamorphism; microbreccia with flow structure
3. **Neogene**: a later Tertiary - Miocene and Pliocene
4. **Lapilli**: pryoclastics ranging from 2 to 64 mm
5. **Leucite**: a white or gray feldspar- like mineral; a important rock-forming mineral in some lavas
6. **Matrix**: the groundmass of igneous rock, or finer grained material around larger grains in a sedimentary rock
7. **Palagonite**: a yellowish glassy substance formed when hot basalt lava flows into cold water
8. **Sial**: the upper layer of the earth's crust, made of rocks rich in Silica and Alumina
9. **Ventifacts**: pebbles scratched or polished by windblown sand
10. **Torque**: the effectiveness of a force than tend to make a body rotate

THE GEOLOGICAL NEWSLETTER

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ANNUAL EVENTS: President's Field Trip-summer. Picnic-August. Banquet-March. Annual Meeting -February,**FIELD TRIPS**: Usually one per month, via private car, caravan or chartered bus.**GEOLOGY SEMINARS**: Third Wednesday, except June, July, August. 8:00 p.m. Room S17 in Cramer Hall, PSU Library :Room S7, open 7:30 p.m. prior to evening meeting **PROGRAMS:** Evenings: Second and Fourth Fridays each month, 8:00 p.m. Room 371. Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon **LUNCHEONS**: First and third Fridays each month, except holidays, at noon, Bank of California Tower, fourth floor, California Room, 707 SW Washington, Portland Oregon. **MEMBERSHIP:** per year from January 1: Individual, $15.00, Family $25.00, Junior (under 18) $6.00. Write secretary for membership applications.**PUBLICATIONS**: *TH GEOLOGICAL NEWSLETTER* (ISSN 0270 5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year (add $12.00 postage for foreign subscribers) Individual subscriptions at $13.00 a year. Single copies $1.00. Order from the Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207. **TRIP LOGS**: Write to same address for price list.

GEOLOGICAL NEWSLETTER

THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY
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VOL. 61, No.4
APRIL, 1995

APRIL ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Lunch with members in cafeteria at 11:30 AM, if desired)

April 7: Recent Eruptive History of Mt. Hood
Ken Cameron, Geologist, State of Oregon

April 21: To be announced by newly-installed co-chairperson Cecelia Crater

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

April 14: Groundwater Cleanup Alternatives and Remediation: Case Histories
Leonard Farr, AGRA Earth & Environment

* April 28: To be announced by newly-elected vice-president Richard Bartels

GEOLOGY SEMINAR: 8:00 PM Portland State University, Cramer Hall, Room S-17

April 19: Eocene/Oligocene of the Northwest
Richard Bartels

* April 28, Friday evening meeting to be held in Room #271 , not 371.

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH! Either write or call Evelyn Pratt.

WELCOME NEW MEMBERS

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Mallory Webb
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NOTICE; The annual spring retreat to the Hancock Field Station will not take place this year. ⊕

SOME JOINTS AROUND PORTLAND

by
John Eliot Allen

I have always been interested in the way in which basaltic lava cracks when it cools into intricate patterns of "joints", A joint is a fracture along which no movement has taken place; if the two sides of the fracture have moved relative to each other, it is called a "fault".

Movement along faults may be from millimeters to hundreds of miles, On the notorious San Andres Rift of California the southwest side has moved northwest for at least 400 miles during the last 40 million years, at a rate averaging at least an inch a year. The theory of plate tectonics, which proposes that the crust of the earth is made of seven large and many small plates which slide around and jostle against each other, pretty much explains why faulting takes place, but the origin of joints in igneous rocks is something else.

Many years ago, a student presented me with a term paper he had written entitled "Some Joints Around Portland". After doing a double-take, I discovered that he had taken color photographs and described in detail large number of outcrops in the Portland area that exhibited joints of various kinds.

Geology teachers have always glibly explained joints by saying "When molten lava cools and solidifies, it contracts and pulls apart, like mud cracks in a drying puddle." Yes, of course it does, but why are the average columns in Columbia River Basalt flows about one foot in diameter while those in the Boring Lavas around Portland are 2 to 3 feet across?

Why are columnar joints Usually found near the bottom of the flow, called the "colonnade", while the upper part of the flow called the "entablature",. has a jumble of joints at all angles breaking the rock into half-brick-sized fragments, called by some geologists "brick-bat" basalt?

Why do we sometimes get fan-shaped splays of thin columns, as in the remarkable road-cut on the freeway south of Cascade Locks? Why do we sometimes get columns radiating out from a center, those in the cliff of Broughton Bluff just east of Troutdale?

I tackled some of these "joint questions" in the Time Travel column (#147) of January 1, 1987, which showed ›lored pictures of four kinds of joints and diagrams of several others. I mentioned the "first law of jointing", which states that columnar joints form at right angles to the surface of cooling, which is usually the base, but may also be found at the top or sides of a lava flow. I described the joints, but I couldn't tell why they were formed the way they do.

In May 20 to 22, 1987 more than a thousand geologists met in Hilo, Hawaii for the 83rd annual meeting of the of the Cordilleran section of the Geological Society of America. A total of 443 papers were presented at the sessions, and 41 of these or more than 9 percent were on the Columbia River Basalt.

Several of these papers presented ideas (hypotheses) about joints. Authors of two of them work for Rockwell Hanford Operations at Richland, where they are trying to find out whether the jointed basalt of the Columbia plateau of Washington will contain radioactive wastes.

Philip E. Long believes that he can prove that the rate of cooling from the top of the flow down is 4 to 12 times faster than that from the base of the flow up, and that this due to the "quenching" of the flows by water from lakes or streams flowing across the still hot lava. The brickbat basalt of the entablature is thus due to rapid quenching from above.

Lava flows in Iceland have long been thought to show evidence of quenching, and when the lava that threatened the village on the island of Heimaey in 1973 was cooled with fire hoses, it developed similar entablatures.

The Columbia Plateau has long been a structural basin, traversed by both the Columbia and Snake Rivers. When lava poured out into the valley it dammed or diverted the rivers which flowed across the still hot rock or produced numerous lakes into which new flows could pour and be quenched.

If the distribution of entablatures in lava flows can be determined, it might be possible to map the topography as it was right after the pouring out of each lava flow. And from that one could map the underground drainage channels in the cindery tops and soil horizons between › flows and determine the probable directions of ›vement of underground waters. Joyce P. Meints mapped the attitude of the joints at different sites, plotting their orientation and spacing. These data were then analyzed statistically to see what the difference was between the joints in the colonnades and in the entablatures. It turned out that sophisticated mathematical manipulations showed that both orientation and spacing did differ for different parts of each flow whose joints were measured.

I have only read the abstracts of these papers, so perhaps ought not judge them severely, but I really don't know much more about jointing than I did before, and I still don't understand why many of the fascinating joint patterns form the way they do.⊕

HAVE YOU EVER WONDERED..

.... ABOUT GOLD?

By Virginia T. McLemore
Senior Economic Geologist, New Mexico Bureau of Mines and Mineral Resources

The relentless pursuit of gold has shaped man's history and will continue to shape our future. Gold is certainly the most romantic of minerals. Men have traveled thousands of miles and risked their lives for gold. The legend of Jason and his Argonants is centered around the search for the fleece of a golden ram. The Egyptians first used gold around 3400 B.C. Promises of new discoveries of gold enabled Columbus to finance his journey to the New World. Coronado and other Europeans traveled across oceans and continents searching for the precious metal. Thoughtout history, many people saw vast amounts of gold as a display of power. The discovery of gold in New Mexico in 1828, in California in 1848, and later in Alaska enticed people to seek their fortunes by traversing the North American continent. Many private fortunes can be traced to the successful mining of gold and silver. Even today, gold is the most sought after metal in the world.

What is gold? Gold is a metallic element with the atomic number of 79 and an atomic weight of 196.9665. A one inch cube of gold weighs 10 troy ounces or 311 grams. The specific gravity of gold is 19.3, which means that it is 19.3 times heavier than water. The average crustral abundance is 0.004 parts per million (ppm). Gold is natrually obtainablr in very high purity because its stable atomic structure resists easy bonding with other elements.

Gold is resisttant to corrosion and oxidation and is a good electrical conductor. Gold is relatively soft, malleable, and ductile; it can be hammered into thin foil sheets or drawn into thin wires. However, it is probably gold's pleasing color, luster (or shine) high density, and relative scarcity that the metal so desirable. Indeed, the common use for gold is jewelry and other ornamental applications. Most nations use gold as a medium for exchange, for settling international debts, and as a standard for monetary transactions.

In the gold industry, the term Karat is used to indicate purity, meaured in 24th. 24 Karat or 24K gold is pure gold whereas 10K is 10/24 or 41.7% gold. Fineness also refers to purity measured in parts per thousand. 1000 fine gold is pure gold. The Troy weight system is used in the U.S. One Troy ounce =,1.097 ounces, avoirdupois = 480 grains = 20 pennyweight. One troy ounce is equivalent to 31.104 grams.

A large portion of the U.S. gold is stored in a vault at Fort Knox Bullion Depository near Louisville, KY, which is under the supervision of the U.S. Director of the Mint. The gold consists of brick-size bars (7x3x1 3/4 inches) that weight 27.5 pounds each.

Gold is also usd in the electrronics industry, dentistry, and aircraft-aerospace industries, and in medical and chemical fields. A thin film of gold electronically adhered to office windows insulates from the cold in winter and keeps out the sun's infrared radiation in summer. Gold coated mirrors in infrared jammers are used by the military aircraft to confuse enemy heat-seaking missiles. Miniature phone jacks are coated with gold to increase reliability. Compact discs can be coated with gold to provide untimate sound quality.

U.S. gold production has increased dramatically in the past 15 years. In 1990, the 9.3 million ounces mined was worth over $3.6 billion. Production for the 1993 is expected to exceed 9 million ounces. Nevada is the leading gold-producing state. Most of the recent production has come from large, open-pit mines (mostly in Nevada) developed in response to price increases of the early 1980s. These mine remained profitable through the price slump of the mid-1980s. As a result, the U.S. dependence on gold imports has dropped.

The first western gold rush in 1828 resulted from the discovery of gold in the arroyos draining the Ortiz Mountains in Santa Fe County (New Mexico). An estimated 450,000 ounces of gold have been produced from the Old Placers district in the Ortiz Mountains. Gold production in New Mexico from 1828 to 1990 was at least 3 million troy ounces, worth approximately $200 million. Some estimates put production at 3.5 million ounces. Much of this was recovered as a by-product of other mining, especially from copper porphyry and lead-zinc deposits. Mines producing only gold are uncommon in the state.

Gold has been found in several types of deposits New Mexico. Placer deposits are generally the first to be discovered because prospectors first investigate stream beds in a given area using a gold pan. Placers are found in arroyos and streams where the gold eroded from earlier accumulations and concentrated by sedimentary processes. Recently, research has indicated that bacteria also may be important in concentrating gold in placer deposits. Gold is typically found in nature as a free metal. However, in some depossits, gold occurs with tellurium to form tellurides. Gold also occurs in trace amounts in other minerals such as pyrite, chalcopyrite, and galena.

Several types of lode deposits are found in New Mexico. Gold has been the most important product in several mining district in New Mexico that lie on or near the boundary between the Great Plains and the Southern Rocky Mountains or Basin and Range physiographic provinces. These deposits have some similar characteristics that, when compared with their tectonic setting, define a class of ore deposits called the Great Plains margin deposits.

These deposits contain both base and precious metals, but precious metals are generally high compared to other ore deposits in the state. One of the largest produci districts is the Elizabethtown-Baldy district near Raton, a Great Plains margin deposit. An estimated 471,400 ounces of gold were produced between 1866 and 1942. Gold has been important in a number of districts including the Mogollon, Steeple Rock, White Oaks, and Cochiti. The coppery porphyry deposite at Santa Rita has produced over 500,000 ounces of gold as a by-product since 1902.

GLOSSARY

Base metals - the common minerals but not iron, copper, lead and zinc.

Coppery porphyry deposits - large, low-grade deposits of disseminated copper and veinlets of copper minerals found in or adjacent to igneous intrusions.

Ductile - capable of being drawn or stretched without breaking; opposite of brittle.

Lode deposits - mineral deposits consisting of veins, or disseminations within rocks; mineral deposits within consolidated rocks.

Malleable - capable of being plastically deformed under stress (such as hammering) without breaking.

Parts per million (ppm) - a unit used for expressing the concentration by weight of an element in a material or lution; the number of parts of an element in one million parts of the material in which it is found.
Placer deposits - surficial mineral deposits formed by gravitational concentrations of mineral grains weathered from lode deposits and transported; unconsolidated deposits.
Precious metals - the less common metal including platinum, gold and silver.

This article on gold was taken from Lite Geology, Fall 1994. Lite Geology is a quarterly publication of the New Mexico Bureau of Mines and Mineral Resources ⊕

CAPSULE GEOLOGIC HISTORY OF THE COLUMBIA RIVER GORGE

by John Eliot Allen

The story read in the rock formations of the walls of the Columbia River Gorge as viewed from onneville is punctuated by three of the most unusual and catastrophic series of events ever to occur on the North American continent.

Western Cascades volcanoes erupting 30 to 18 Ma (million years ago) built up a three mile thick pile of volcanic ash, lava and mudflows. The lower cliffs north of Bonneville Dam and the roadcuts along eastbound I-84 south of the dam expose 1,000 feet (621 m) of mudflows containing numerous petrified tree trunks.

The first series of major catastrophic events, 16-12 Ma, was the eruption from dozens of fissures in eastern Washington and Oregon of fantastic floods (41,000 mi$\backslash^3$ or 170,000 km$\backslash^3$ of basaltic lava so hot and fluid that flows spread to cover 60,000 mi$\backslash^2$ (164,000 km$\backslash^2$) of the two states.

Sixteen of 270 known basalt flows can be seen in Gorge cliffs. Several flows reached the sea through at least two ancestral Columbia River valleys located many miles to the south. When a former river valley of the Columbia was filled with saltic lava, the river was displaced north, and cut a new valley. The present gorge is near the northern edge of these lavas.

During the last 7 million years gray andesitic lavas from several of the 3,000 volcanoes which built the surface of the Cascade plateau displaced the river for the last time. These lavas completely filled a deep ccanyon 10 miles south of the present Gorge, which already contained 1,000 feet of river sands and gravels washed down from Canada.

The Columbia in its present course, increased for 2 million years by meltwater from the ice sheets in Canada, was able to keep pace with the 4,000 feet (1,200 m) uparching of the central Cascade Range and cut a deep canyon with a V-shaped cross-section.

The rocks of the 14 major High Cascade volcanoes and many basaltic cinder cones have normal magnetism, which means that they were built since the reversal of 700,000 years ago.

The second series of major catastrophies began 15,000 years ago near the end of the Ice Age, when a ice lobe from Canada moved across Lake Pend Oreille and up the Clark Fork valley in Idaho to form an ice dam 2,500 feet (762 m) high which impounded a lake in Montana with 1/5 of the amount of water in Lake Michigan.

When the lake overtopped, broke and washed the dam, 500 mi$\backslash^3$ (2,084 km$\backslash^3$ of water scoured across eastern Washington, cutting out Grand Coulee and hundreds of miles of other now high and dry coulee valleys. For 3,000 years ice dams reformed 40 to 100 times, lake refilled, and catastrophic flows recurred.

In the Columbia River Gorge, these floods cut away walls and changed the V-shaped cross-section to the present U-shape, resulting in the waterfalls on the cliffs south of the river. Flood waters reached elevations of 1,000 feet (305 m) at the Dalles, 750 feet (229 m) atop Crown Point, and 400 feet (122 m) at Portland.

A third catastrophe only 750 years ago was the Cascade Landslide, perhaps caused by a great earthquake. The flood-steepened faces of Table Mountains and Greenleaf Peal north of Bonneville crashed down and spread out to cover 14 mi\2 (35 km\2, displace the river more than a mile to the south and build a debris dam across the river 270 feet (82m) high. Bonneville Dam is now only 80 feet (24 m) high.

Forests along the river as far east as the Dalles were drowned as the lake filled behind the dam. Indian tribes were able to cross the river dry shod for months or years before the dam was topped and washed away, resulting in the Cascades of the Columbia. They remembered this, which gave rise to the legend of the "Bridge of the Gods".

IF YOU CARE TO READ FURTHER

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______________, Burns, Marjorie, and Sargent, Sam C., 1986, Cataclysms on the Columbia , a layman's guide to the features produced by the catastrophic Bretz floods in the Pacific Northwest: Timber Press, Portland, 211 p.

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The above article was taken from THE GEOLOGICAL NEWSLETTER, December, 1989p. 63-164. ⊕

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LIBRARY NEWS

by Esther Kennedy

CYCLES OF ROCK AND WATER AT THE PACIFIC EDGE by Kenneth A. Brown was presented to the GSOC Library by GSOC member Bill Greer.The book is the story of research along the Pacific Coast from Baja, California to the Aleutian Islands. Brown spent five years in research, traveling twenty thousand miles, often on field trips with eminent geologists and biologists. The author received his under graduate degree in geologyand English from Stanford University and a graduate degree from Columbia School of Journalism.⊕

THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY ENDOWNENT FOR OMSI'S CAMP HANCOCK.

.The Oregon Museum of Science respectfully announces the establishment of an endowment to be called "The Geological Society of the Oregon Country Endowment for OMSI'S Camp Hancock" This endowment is being founded through the stated wishes of Margaret L.Steere, and in memory of her by OMSI and Lois Beattie, the executor of her estate.

The interest income the endowment will be used annually to purchase books, educational materials, and research and outdoor equipment for OMSI's Hancock Field Station (Camp Hancock).

The principal of the endowment will be protected in perpetuity. A statement of the endowment earnings and expenditures will be submitted to the Geological Society of the Oregon Country on an annual basis. The endowment will be invested with other OMSI funds as stipulated in the OMSI Investment Poliicy document.

Donations may be made in care of:
The G.S.O.C. Endowment for OMSI,s Camp Hancock, OMSI Development Office, 1945 SE Water Ave. Portland, OR 97214.

Contacts:
Lois Beattie, executor, 9930 SW Quail Post Road, Portland, OR 97219, Phone 503-245-5082

Barbara Brunkow, Vice President, OMSI Development Office, 1945 SE Water Ave. Portland, OR 97214, Phone 503-797-4531

Joesph Jones, Director, OMSI Eastside Science Camps, 7171 SW Quarry Ave., Redmond, OR, Phone, 503-548-5473

Geological Society of the Oregon Country
C/O Don Barr, 12438 SW Orchard Hill Road
Lake Oswego, OR 97035, Phone 503 -246-2785

MAY 95

THE GEOLOGICAL NEWSLETTER

GSOC

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Co-Chair, Lois Sato 654-7671

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ANNUAL EVENTS: President's Field Trip-summer. Picnic-August. Banquet-March. Annual Meeting -February,**FIELD TRIPS**: Usually one per month, via private car, caravan or chartered bus.**GEOLOGY SEMINARS**: Third Wednesday, except June, July, August. 8:00 p.m. Room S17 in Cramer Hall, PSU Library :Room S7, open 7:30 p.m. prior to evening meeting **PROGRAMS:** Evenings: Second and Fourth Fridays each month, 8:00 p.m. Room 371. Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon **LUNCHEONS**: First and third Fridays each month, except holidays, at noon, Bank of California Tower, fourth floor, California Room, 707 SW Washington, Portland Oregon. **MEMBERSHIP:** per year from January 1: Individual, $15.00, Family $25.00, Junior (under 18) $6.00. Write secretary for membership applications.**PUBLICATIONS**: *Th. GEOLOGICAL NEWSLETTER* (ISSN 0270 5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year (add $12.00 postage for foreign subscribers) Individual subscriptions at $13.00 a year. Single copies $1.00. Order from the Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207. **TRIP LOGS**: Write to same address for price list.

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THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY
P.O. BOX 907, PORTLAND, OR. 97207

VISITORS WELCOME
INFORMATION PHONE 284-4320

VOL. 61, No.5
MAY, 1995

MAY ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room.
(Lunch with members in cafeteria at 11:30 AM, if desired)

May 5: TBA

May 19: The Mayans
Andy Corcoran, ex-president of GSOC

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

May 12: Glaciers in Antarctica
Andrew Fountain, Cascade Volcano Observatory

May 26: Ancient History and the Use of Building Stone in Turkey
Dennis Olmstead, DOGAMI

GEOLOGY SEMINAR: 8:00 PM Portland State University, Cramer Hall, Room S-17

May 17: The Tertiary Geology of Portland Background information for summer field trips
Richard Bartels, GSOC vice-president

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Between June 16 and July 9, Dr. Paul Hammond will lead his popular CASCADE VOLCANOES weekend field trips. This year's added incentives: (1) Cost per trip has been reduced to $175 for non-credit participants; (2) during third field trip, stay one night at renovated Crater Lake Lodge on lake rim. Call Evelyn Pratt, 223-2601, for further details.

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ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES MUST BE SUBMITTED TO THE CALENDAR EDITOR BY THE 15TH OF THE MONTH! Either write or call Evelyn Pratt.

WHAT'S A TERRANE?

by Eveyln. Pratt

(condensed from Structural aspects of structural terranes and accretionary tectonics of western North America, by P. J. Coney, in Jour. of Structural Geology, v. 11, p. 107-125)

A terrane is an independent geologic region, characterized by a logically connected stratigraphic sequence which was more or less continuously deposited. The distinctive lithologic sequence represents a geologic history different from that of adjacent terranes or a nearby craton. There may or may not be a preserved 'basement'. By definition, all terranes are bounded by faults. Operationally, limits of terranes are (a) major discontinuities in stratigraphy or lithology, and (b) an either proven or suspected fault. The terrane concept emphasizes the uncertainty of the original paleogeographic relationships between one terrane and another or between a terrane and an adjacent craton. Terrane boundaries may range from horizontal to vertical.

Types of terranes (a) *Stratigraphic*: terranes with a stratigraphic succession that is observable. (b) *Disrupted*: those that lack coherent stratigraphy, due to internal shearing or faulting. (c) *Meta-morphic and/or plutonic*: crystalline complexes defined by their particular fabrics or lithologies.
(d) *Composite*: may be result of the joining together of two or more terranes prior to final accretion at a continental margin. The resulting amalgam is sometimes referred to as a 'super terrane', which is thus made up of two or more 'sub-terranes'. Terranes and their boundaries may be overlapped by sedimentary or volcanic assemblages which tie the terranes together, or boundaries may be intruded by plutons.

Accretion The term should be limited to mean an addition of rock material to an original continental 'nucleus'. Tectonic accretion takes many forms; it would include the collision of near or far travelled objects with a continental margin, and their welding into that continent. Any oceanic lithosphere that originally lay between a terrane and a continent is assumed to have been disposed of somehow, usually by subduction.

In some subduction zones, the off-scrapir of trench fill and/or sedimentary and volcanic venee from ocean crust against a continent produces *'accretionary wedges'*. This is another form of tectonic accretion. Material carried down subduction zones and underplated beneath a continental margin is also tectonic accretion. In addition, theoretically a magmatic arc could be constructed, all or part of which is on ocean crust next to a continental margin. Tectonic telescoping could add this arc terrane into the continent. There is evidence of tectonic wedging and delamination, where thin slices are detached from underlying continental or oceanic lithosphere and coated onto a continental margin.

Already-accreted terranes may be dispersed by margin-parallel strike-slip faulting, and be re-accreted somewhere else. Commonly, terranes are slivered and fragmented this way. Along with translation, there is considerable evidence of rotation about vertical axes. Finally, the North American Cordillera shows a lot of evidence for considerable intraplate consolidation of the original structur after accretion. The terranes have been fragment and rearranged by large-scale, long-term thrust faulting, strike-slip faulting, and extensional normal faulting.

Terrane-specific or not? Is a feature confined to a terrane or isn't it? Some structures may have formed before accretion, and represent tectonic events that have nothing to do with the orogenic belt they are now found in. Or, on the other hand, the structures may represent a particular structural response to the surroundings during or after accretion. Either of these is often hard to date. Anything else that affects only the terrane and not its boundaries, such as volcanism or unconformable overlaps, is suspect.

Faults and accretionary tectonics Faults that bound terranes are *terrane boundary faults*, while those that cut through or across terranes are *non-terrane boundary faults*. In reality, few terr boundary faults seem to represent origi accretionary terrane boundary structures.

Common in the Cordillera is a strike-slip fault where the amount of movement is very large. 'ıe tintina and Denali faults of Canada and Alaska are examples of this type. On these faults there has been so much lateral displacement that terranes have been fragmented and dispersed into now separated pieces.

Farther out or oceanic terranes are often found as thin thrust sheets or rootless nappes sitting on more inboard terranes or on the craton. This has been modified by much strike-slip faulting after the terranes were accreted, and by thrust faulting and detachment faults.

According to observed geological relationships, the total displacements of some Cordilleran terranes has been as much as 2000 km; paleomagnetic evidence implies that there has been much more. The terranes have been moving north from later Mesozoic until now. From eastern Alaska to northern Mexico, the evolution of the Cordillera has been marked by intraplate telescoping along thrust faults after the terranes were accreted; by strike-slip faulting; and by peeling off at middle and upper-crustal levels.⊕

GREAT BRITAIN'S CLASSIC GEOLOGICAL SITES

Program Dates: September 2-24 , 1995

Dr. Dick Thoms, Portland State University, Department of Geology will be leading this trip. It is open to persons interested in Geology. The trip will take participants through some of the classic terrain of stratgraphy and historical geology of England. For more information you can contact Dr. Dick Thoms at PSU or Folkways Institute at 658-6600 .⊕

Thank you, Arthur Springer for the gift of the laser pointer. This pointer is a great help to those who present programs at both evening and noon ˈluncheons.⊕

DISPLAYS DELIGHT DINERS

by Charlene Holzwarth.

The crowd-pleasing displays at the 1995 Geological Society of the Oregon County's Banquet on March 10th, 1995 were viewed with great interest by our members and friends.

The Oberson and Wilcox photos and Lon Hancock's recording were brought by Don Parks. Ruth Keene brought an extensive set of model crystal structures. Reba Wilcox sent some of the original "mock-ups" from her husband's campout guides. Esther Kennedy brought her microscope and case of micro mounts so we could view a part of her extensive collection of miniature crystals. The Department of Geology and Mineral Industries was represented by a large earthquake exhibit, one of their traveling displays. Beverly Vogt brought this colorful and instructive arrangement.

Evelyn Pratt brought an exhibit of items collected on their many explorations in the Northwest. Dr. Ewart Baldwin brought some of his books used widely for the study of geology of our area. (Available locally at the Nature of the Northwest shop in the Oregon Building, 800 NE Oregon, Portland.)

Not only did Don Turner bring an interesting model train set loaded with mineral and rock specimens but also helped get the exhibits organized. Dorothy Barr's beautiful fossil exhibit was a welcome addition to the evening.

We appreciate these members who have given their time and energy to add to the interest of our annual banquet.⊕

The Geological Society of the Oregon 1995 Banquet

The Geological Society of Oregon 1995 Banquet was a great success. Evelyn Pratt and Esther Kennedy worked hard at getting the Banquet organized and seeing that all the pieces fited together to make a successful Banquet. The sales table was successful in selling a variety of material including rock, crystals and reading material.

Publications of the Society's President's Campouts was well received. The exhibits were educational and enlightening. The food was excellent. The new board was sworn in by Bill Greere. The passing of the ":Two Islands" and the ceremonial miners pick was passed to the incoming President Clay Kelleher by Don Botteron. The evening was capped by a most enlightening lecture by Ansel Johnson, Professor of Geology at PSU.⊕

BATHROOM DUCKIES MAKE RESEARCH FUN

On January 10, 1992, a dozen shipping containers washed overboard from their vessel during a storm in the North Pacific Ocean while the ship was enroute from Hong Kong to Tacoma, Washington. One of the containers broke open, releasing 29,000 plastic duckies and other bathtube animals. Ten months later after the spill, toys were discovered on the beaches near Sitka, Alaska. Beach combers who found and reported the toys played a large role in the data collection for scientists tracking ocean current pathways.

The first reported group of beached toys was found near Sitka on November 16, 1992. The second sighting of the fugitive toy animals occurred twelve days later. To enlist public beach goer's assistance in the data gathering, scientists ran advertisements in area newspapers. Over the next ten months, about 400 hundred toys, including yellow ducks, blue turtles, green frogs, and red beavers, were positively identified along a 850 km of shoreline between Kodiak Island and Coronation Island.

Still the traveling toys pressed on. Some of them floated northward until they became entrapped in seasonal ice of the southwest Bering Sea. After spring thaw of 1994, some of the ducks and their companions were presumed to have followed typical drift patterns northward through the Bering Strait, passing into the Artic Ocean and traveling north of Siberia, eventually reaching the North Atlantic Ocean.

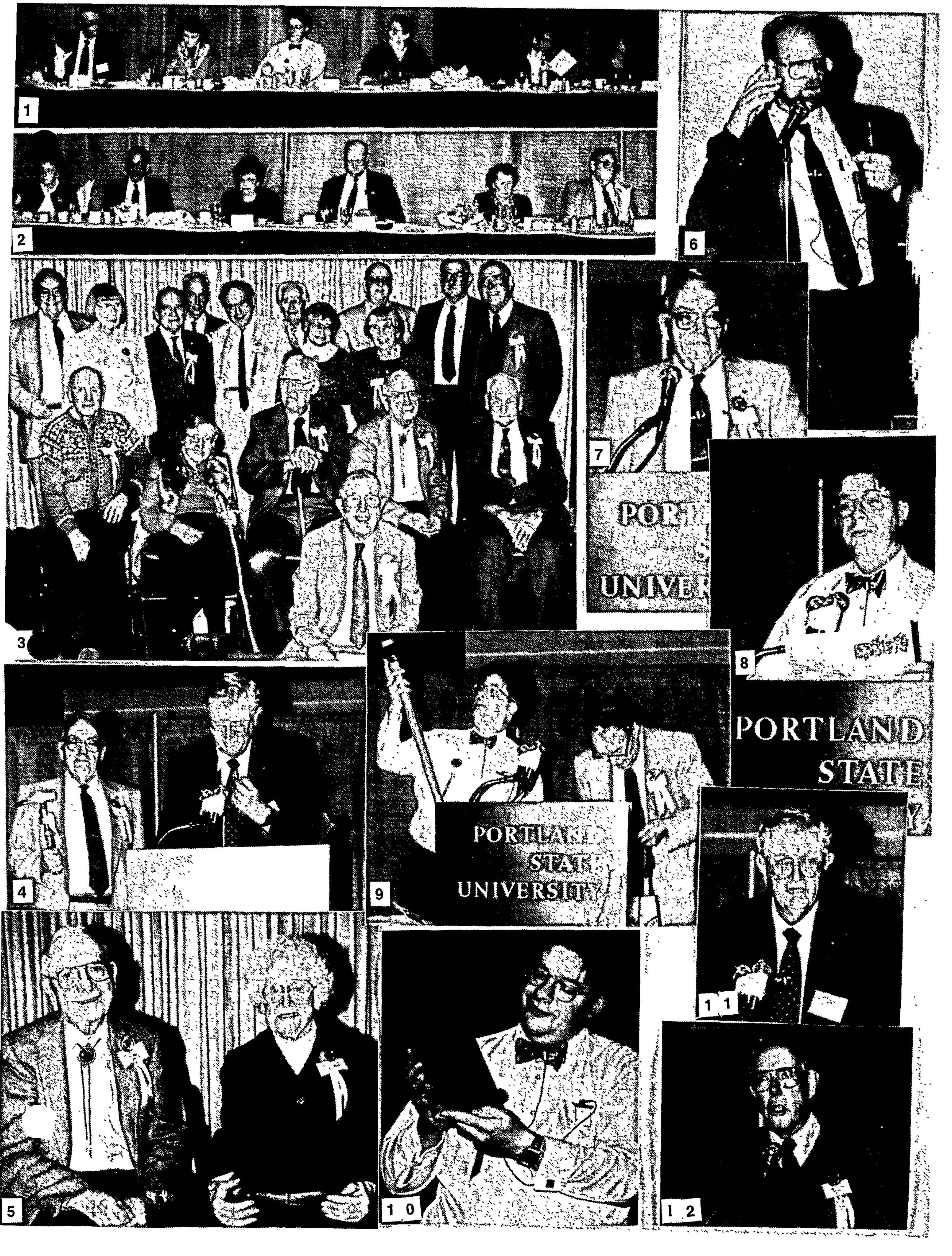
Flocks of duckies and friends who did not enter the Bering Strait may have migrated south instead following the Gulf of Alaska gyre (a surface current loop) interesecting with their own spill site and heading for Washington and Oregon shorelin A lone toy found at Ocean Park, Washington on November 10, 1994 is believed to have followed this pathway.

Oceanographers Curtis Ebbesmeyer and W. James Ingraham are using a computer model to estimate the trajectory of the drifting toys as they travel along the surface of the seas. The plastic toys float so high in the water that they have extra windage (they get extra push from the wind) which makes them good

PICTURES OF 1995 BANQUET

Photographer, Robert Richmond

1. **Head Table**: M.C. Bill Greer, Mrs. Greere, In coming President for 1995-96 Clay Kelleher, Mrs. Kelleher, , Board Member Booth Joslin, Secretary Carol Cole
2. **Head Table**: Treasurer Phyllis Thorne, 1995-96 Vice-President Richard Bartels, Beverly Vogt, Banquet Speaker Dr. Ansel Johnson, Mrs. Betty Botteron, 1994-95 President Dr. Donald Botteron
3. **Past Presidents**: Top row: Dr. Donald Botteron (1994), Rosemary Kenney(1989), Donald Parks (1985), Ralph Mason(1967), Donald Turner(1980), John Bonebrake(1975), Evelyn Pratt(1992,Robert Waiste(1978), Esther Kennedy(1993), Dr. Walter Sunderlund(1991), R.E. "Andy" Corcoran(1987), Seated:Donald Barr(1968), Ruth Keen(1982,1990), Dr. John Allen(1946, Louis Oberson(1984), Archie Strong(1971), In Front: Clair Stahl(1974,1983).
4. 1994-95 President,Dr. Donald Botteron, M.C.Bill Greer.
5. **Charter Members** Louis Oberson, Mildred Phillips
6. **Banquet Speaker** Dr. Ansel Johnson.
7. **1994-1995 President** Dr. Donald Botteron,
9. **Clay Kelleher** receiving the honorary pick
8. **1995-1996** President Clay Kelleher,rary pick
10. **Clay Kelleher** holding "Two Islands"
11. **M.C.** Bill Greer
12. **"Andy Corcoran"** with memorial to Margaret Steere.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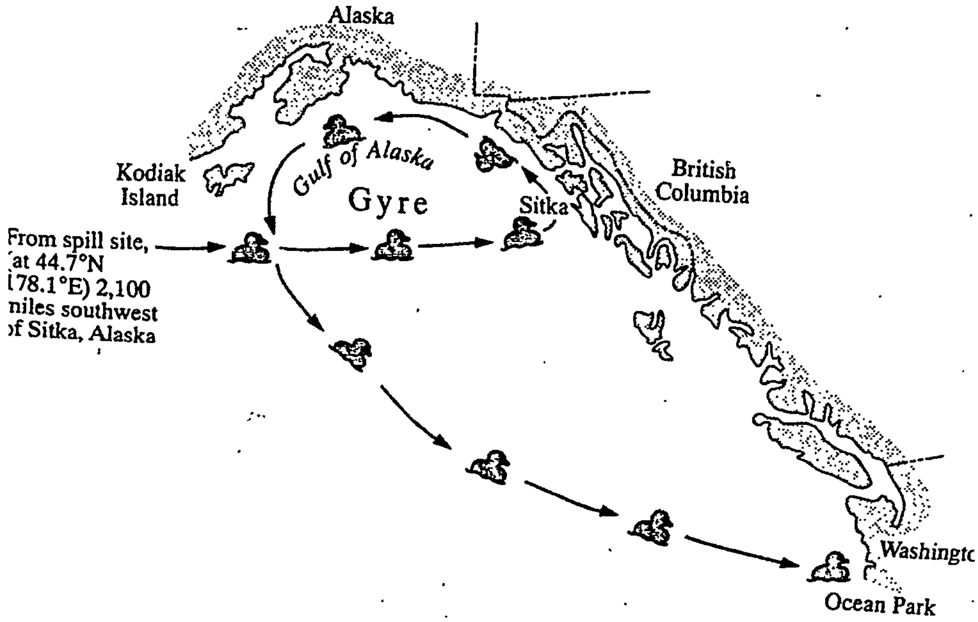

travellers. Both scientists anticipate that by the year 2000, some of the 29,000 floating toys will be sighted at many oceanic locations in the Northern Hemisphere. These researchers welcome any help in reporting subsequent finds of the toys (which are labeled "First Years" or any other interesting floating objects.

CONTACT:

Curtis Ebbesmeyer, Evans-Hamilton, Inc., 731 Northlake Way, Seattle, WA 98103.

W. James Ingrham, Resources Ecology and Fisheries Management, Alaska Fisheries Science Center .National Marine Fisheries Service, .NOAA, 7600 Sand Point Way, NE, Seattle, Washington 98115-0070

SOURCE:

Ebbesmeyer, Curtis C., and Ingraham, W.J.,Jr., Pacific toy spills fuels current pathways research: ESO,

Transactions, American Geophysical Union, v.75, no.37, pp. 427, 430.

___Story by S.Welch and T. Click; map by K. Campbell.

The article on "Bathroom Duckies Make Research Fun" appeared in Lite Geology, New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801.⊕

TODAY'S CHUCKLE

A young fellow from the university brought a classmate home to the ranch with him during summer vacation. His mother heard snatches of conservation now and then. One day, she said to her husband, "I sometimes wonder what goes on there at the university. They talk about fault and sin clines and Aunti Cline and perfect cleavages, and lots girls with odd names like Peg Matight and Rhoda Crowsite. Then there's a fellow called Si Lomoneland and Sue Doughmorf who was after Cal's Site, poor guy. Bill said he got some quarts from the gang at the mine. I wish he wouldn't drink. His friend said he got a piece of Nice on the dumps, too. Well, I'm glad Bill's home for a few days. I heard him say he didn't have any Apatite, and I can give him some good home cooking.⊕

DID YOU KNOW:

That during the period of March 15-28 the number of seismic events in Oregon, Washington, Alaska, California, and world wide were as follows:

	1-2	2-3	3-4	4-6	5-6	6+
WA	10	0	0	0	0	0
OR	3	0	0	0	0	0
N-CA	60	24	2	0	0	0
S-CA	212	48	1	0	0	0
AK		45	7	3	0	0
World wide				67	29	2

JUN 95

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VISITORS WELCOME — VOL. 61, No.6
INFORMATION PHONE 284-4320 — JUNE, 1995

JUNE ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Lunch with members in cafeteria at 11:30 AM, if desired)

June 2 — Petrified Wood: Many Challenges to the Rockhound
Gertrude Hall, past president, Oregon Agate & Mineral Society

June 18: — Australia
Helen Nelson, GSOC

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

June 9: — Stream Dynamics on the Clackamas River
Mark Darienzo, Portland Community College

June 23: — A Revisit to the Light Rail Tunnel Project
Rod Morrison, Project Geologist, PBQ&D
Ken Walsh, PSU graduate student working with PBQ&D

GEOLOGY SEMINAR: 7:30 PM (Note time change) Portland State U., Cramer Hall, Room S-17

July 5 [redacted]: — Rock Study for Geology Novices (Preparation for field trip)
Clay Kelleher, GSOC President; Richard Bartels, GSOC vice-president

FIELD TRIP: 8:00 AM, J[redacted] July 8
Walk to a Rock: A walking tour of downtown Portland buildings.
Meet in front of 1721 SW Broadway (Cramer Hall, PSU)
Led by Clay Kelleher & Richard Bartels

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Between June 16 and July 9, Dr. Paul Hammond will lead his popular CASCADE VOLCANOES weekend field trips. This year's added incentives: (1) Cost per trip has been reduced to $175 for non-credit participants; (2) during third field trip, stay one night at renovated Crater Lake Lodge on lake rim. Call Evelyn Pratt, 223-2601, for further details.

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1995 G.S.O.C. President's Campout August 7-13 (Mon-Sun)

Stratigraphy of the Northern Oregon Coast Range

(Tentative information as of 5/12/95, subject to change)

Leaders: Administrative: Clay Kelleher, GSOC President
Professional: Robert Van Atta, PSU Geology Dept., Professor Emeritus
Leonard Farr, AGRA Earth & Environmental, Geologist
Scott Burns, PSU Geology Dept., Associate Professor
(probably one other professional leader to be announced later)

Field Trip Headquarters: Jones Creek Campground (Oregon Dept. of Forestry), near Lee's Camp (MP 28) on Wilson River Highway. This campground is centrally located for geologic stops, and has been reserved for GSOC, but has no RV hookup and appears to be half-hour drive from nearest motel. Your President will attempt to find a campground where as many participants as possible can congregate at each day's end. Suggestions welcome.

Weather: should be fabulous
Cost (not including your own food, gas, and motel): probably less than $50

Schedule (very tentative):

Sunday, Aug 7:	Set up camp,"Welcome to GSOC" Campfire
Monday, Aug 8:	Stratigraphic Overview of Northwest Oregon, plan for the week will be to view geologic units from oldest to youngest, though some will be seen out of order to save backtracking. First formation: Siletz River Volcanics, possibly on Hwy 18 or Trask River road, and maybe Tyee and Nestucca Formations.
Tuesday, Aug 9:	Yamhill and Spencer Formations, probably near Hagg Lake.
Wednesday, Aug 10:	Hamlett and Cowlitz Formations, in vicinity of Vernonia and Timber.
Thursday, Aug 11:	Selection of optional side trips, including hike up Saddle Mtn., Astoria area attractions, etc.
Friday, Aug 12:	Cowlitz, Keasey, and Pittsburg Bluff Formations, near Hwy 6 and Hwy 47.
Saturday, Aug 13:	Scappoose Formation and Columbia River Basalt, Quaternary events, Vernonia and Hwy 26
Sunday, Aug 14:	Columbia River Basalt and Astoria Formation interfingering, "Farewell Campfire"
Monday, Aug 15:	Break camp

COMPLETELY FRACTURED GEOLOGY

by Kathleen & Peter Serrell and Marge & Costa Columbus

1. **dendrite**: (1) as in "First she was wrong, dendrite." (2) correct housing for bears.
2. **karst**: thrown; as in, "He just karst it away."
3. **foreset bed**: one that's been shortsheeted.
4. **leachate**: as in "That darn leachate some blood right out of my ankle!"
5. **cinnabar**: a small foil-wrapped block of chocolate.
6. **bajada**: what a Russian says who wants to go south of California.
7. **dripstone**: animated TV show about cave nerds.
8. **acmite:** what someone says when he/she sees a little red crawler on a favorite plant.
9. **isotope**: revision of an old song: "Eyes of blue, isotope, Could she, could she, could she cope. .."
10. **chatoyancy**: a castle in the south of France.

Correct definitions on Page 36

MEDITATIONS ON EQUILIBRIUM PUNCTUATIONS IN OREGON

by John Allen
Portland State University, P.O.Box Portland, Oregon 972207

ABSTRACT Periodicity of abrupt geologic changes can occur on all scales from days to millions years. Many examples of landform changes can be illustrated by features in Oregon that have been produced not only by earthquakes and volcanism but also by erosion and glaciation.

INTRODUCTION: Quite recently in this old-timer's life Eldridge and Gould (1972) proposed that instead of evolving slowly and evenly, life forms remain static for long periods, and then are "punctuated" by sudden and abrupt and obvious change. This revolutionary new idea of "punctuated equilibrium" caused me to rethink several features in Oregon that have puzzled me.

In the 20's and 30's my generation was taught "uniformitarianism": that the past is to be interpretated through what we see going on in the present. Evolution and geologic activities was thought to progress more or less evenly and steadily, except for earthquake and volcanic activity.

Although William Morros Dale had early proposed (1909) the anthropomorphic periodic stages of "youth, maturity and old age", it wasn't until the 60's that quantitative geomorphologists (Strahler (1969, 1971), Leupold, et al.(1964), began to demonstrate that periodicity could be important in landform development and I began to realize that this idea of a "punctuated equilibrium" can be applied to more than evolution, it can also appear in abrupt instead of slow regular changes in landforms.

By this time "absolute" age-dating methods were supplementing the "relative" determinations of geologic age by fossils and stratigraphic correlation. Numerous techniques enabled determination of periodicities by use of U/Pb, K/Ar, C/14, magnetic reversals, growth of lichen, obsidian hydration and variations in tree rings. Now we are even searching for periodicities in earthquake and volcanic events.

CATASTROPHIC EVENTS On a large scale, the suggestion by Alverez, et al. (1980) of dinosaur extinction caused by a K/C comet impact led to another hypotheses of twelve periodic mass extinction's with a periodicity of 26 million years (Ramp & Specks, 1984). This was later explained by an hypothesis that the earth was periodically bombarded by comets and meteorites pulled out of the "Oort Cloud" by a "Nemesis" passing star.

Atwater (1987), Peterson, et al. (1989), and Darienzo, et al., (1995) recognized periodic occurrence of tsunami-generated sand layers alternating with peat in the swamp deposits of Oregon coastal estuaries which supply ample evidence of past giant (more than Richter 8) subduction zone earthquakes. More than six of these have occurred at 400-year intervals (actually varying from 200 to 600 years) during the past several thousand years.

EROSION Erosion is easily the most obvious and yet perhaps the most neglected geologic candidate for recognition of sudden rapid change. Equilibrium in erosion by water is a delicate balance, easily disturbed by changes in any one of a number of variables. The "profile of equilibrium" of a graded stream was emphasized by Mackin (1948). Erosion and deposition in humid regions, except for karst, is accomplished during heavy periodic rainfalls, floods and landslides which occur for only a few days a year, or in arid climates may not occur for many years. The Army Engineers have actually calculated the effects of 10-year, 50-year and 100-year floods.

A common sight along roads in the residential Portland Hills such as Terwillinger Boulevard are trees that have a distinct bend near three base, which I was taught to attribute to soil creep; the trees have been tilted downhill by creep and then straightened themselves up. I no longer think that creep is a continuous slow process, I am sure it occurs almost entirely after period rainstorms.

As a longtime student of the Columbia River Gorge (Allen, 1932, 1964) I only recently realized that the narrow deeply incised chutes, which occupy much of the canyon walls between the main tributary canyons, were almost entirely eroded by periodic gully wash-outs after heavy rains during the last twelve thousand years (Holocene). This become evident when every few years the culverts on the scenic highway are blocked after rainstorms with coarse debris and mudflows which may even cover most of the roadway.

Landslides are sudden and effective periodical events, frequently caused in Oregon by rainstorms, but also due to earthquakes. For many years in teaching the textbook chapter in physical geology on mass wasting I would predict that if Portland had ten days of steady rain, there would be a million dollars worth of damage done by slides in the Portland Hills. In 18 years I never missed.

During the last year or so, highways were block by mudslides east of Tillamook and on the coast south of Bandon and at Neahkahnie Mountain north of Nehalem. In the long run, major landslides, however, result from earthquakes. The mud slide that covered an Indian village at the northwest tip of the Olympic Peninsula about 4000 years ago, and the Cascade or Bonneville landslide about 2000 years ago were undoubtedly initiated by great earthquakes. Earthquake generated slides probably dammed Triangle Lake northwest of Eugene and Loon Lake south of Scottsburg. Periodicity of these landslides might be correlated with the evidence of coastal tsunamis.

Oregonian have been justly proud of their crystal-clear mountain streams, never asking how these tree-covered canyons were cut by erosion. Clear water does not erode (except in limestone), so they must have been deepened only during periodic flooding, when the debris supplied from the valley walls by creep and landslide is scoured out. T' debris moved down stream during great floods, eventually to be deposited in flood plains, alluvial fans or deltas.

A longitudinal section of a gravel bar, shows that it is entirely composed of "forset beds" dipping downstream . Only during each flood does the gravel bar progress downstream by debris being rolled along the surface and down the sloping front of the bar.

Ice, of course, is another effective and frequently periodic erosion agent. During a particularly hard freeze in 1970, so much ice was collected at Multnomah Falls that a miniature glacier more than 500 feet long and 50 feet thick moved down the canyon below the falls and broke the abutments of the highway bridge east of the Lodge (Allen, 1984, p. 65.

Multnomah Falls is only one of many in the Go that drop over cliffs which now lie at the back of 100 to 500 feet wide amphitheaters recessed several hundred feet from the main cliffs produced 12,000 years ago by the Bretz floods. It was only after seeing Multnomah Falls in 1970 after a severe freeze that I could explain this erosion. Freezing winds during periodic extra cold winters blow the spray back and forth; it freezes in joints of the brickbat and pops the blocks out.

VOLCANISM The High Cascade volcanoes suggest periodicity of volcanic activity. Their relative ages can be determined by the degree of glacation to which they have been subjected. Since most of their rocks are magnetically normal; they are less than 700,000 years old.

Thielson, Washington, Three-Finger Jack and the North Sister are older than the Middle Sister, Jefferson, Hood, Shasta, Adams and Baker. The youngest are St. Helens, Mazama, South Sister and Lassen. The detailed study of Mt. St. Helens has shown periodicity. Retallick (1981) has described thick sections of volcanic ash or tuff of the Clarno, John Day, Mascall Formations that show numerous periodic (and colorful) fossil horizons.

SCALES OF PERIODIC PUNCTUATION OF EQUILIBRIUM

Hours to months; earthquake aftershocks

Days to months: earthquakes; rainstorm floods; some small landslides; bent trees

Years: minor faulting earthquakes; annual floods; small landslides; gully washouts; gravel bar progression

Decades: major faulting earthquakes; 10 year floods; numerous landslides; volcanic debris flows; glacial flash floods or "johkulhaups" "El Nino" climatic changes

Hundreds of years: subduction-zone earthquakes; great landslides; hundred-year floods; glacial outbursts; volcanic activity; climatic change

Thousands of years: glacial intervals (Little Ice Age); climatic change; paleosoils

Millions of years: extinctions; "Nemesis" (comet impacts?); great basaltic floods; new species

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-------------------(1971, The earth sciences: 2nd Ed., New York, Harper & Row, 824 p.⊕

CORRECT DEFINITIONS adapted from <u>Dictionary of Geological Terms</u>, ed. by Bates & Jackson for AGI, 1984, and from <u>Random House Dictionary</u>, 1987. E. Pratt

1. **dendrite**: a branching tree-like figure produced on a rock when a foreign mineral (usually manganese oxide) crystallizes on its surface.
2. **karst**: topography that forms over limestone or dolomite, which is characterized by sinkholes, caves, and underground drainage systems.
3. **foreset bed**: the slanted layers in a cross-bedded unit, specifically on the front slope of a delta or the lee side of a dune.
4. **leachate**: a solution of water and dissolved substances that the water acquired as it passed through soils.
5. **cinnabar**: a brilliant red crystalline mineral which is the main ore of mercury.
6. **bajada**: an alluvial (made of waterlaid sediments) plain formed at the base of a mountain by the coalescing of several alluvial fans.
7. **dripstone**: calcite or other mineral deposit formed in caves by dripping water; stalactites, stalagmites, flowstone, cave onyx, travertine.
8. **acmite**: a brown or green pyroxene mineral found in certain alkali-rich igneous rocks.
9. **isotope**: any of two or more forms of a chemical element, having the same number of protons but different numbers of neutrons in the nucleus; isotopes can be separated from one another because they have slightly different weights and other properties.
10. **chatoyancy**: the appearance of certain minerals in reflected light, in which a movable wavy or silky sheen is concentrated in a narrow band that changesposition as the mineral is turned; one example is "cat's-eye".

THE BIG BLUE DIAMOND

The world's largest flawless diamond was re-discovered recently in Bombay, India. The 17th century Kingdom of Golconda (now just a ruined fort in the State of Andhra Pradeshh) was the site of some of the greatest diamond discoveries of all time. Such stones as Koh-i-Noor (now set in the British Crown Jewels) and the Idol's eye (at 70.21 carats - the largest known natural diamond in the world) were unearthed there. One diamond from that era, cut to more than 50 carats was believed to have been set a (along with the Koh-i-Noor) into the Peacock Throne of Shah Jehan, the Mogul Emperor of India who built the Taj Mahal.

Then, in 1739, Persia's Nadir Shah invaded India, seized the Peacock Throne and stripped it its most important gems. The 50 carat diamond was never seen again until recently, when it was rediscovered in Bombay.

London's Lawrence Graff purchased it, had it repolished in New York (the polishing reduced it to 47.29 carats) and then sent it to the Gemological Institute of America for certification. GIA gave it a "D" flowless rating-making what they believe is the largest flawless "D" diamond in the world. This magnificent diamond has now been named "The Golconda D"⊕

EARTHQUAKE MAP AVAILABLE

The full-color map "Earthquakes of Washington and Oregon, 1872-1993" is now available as USGS Open-File Report 94-226A. It sells for $12 for a plain copy; $22 for a laminated copy. Order from: U.S. Geological Survey, National Earthquake Information Center. Box 24046, Mail Stop 967, Denver Ferderal Center, Denverm CO 80225. Pri[illegible] ncludes shipping and handling; add $6 for shipp[illegible] outside the U.S.⊕

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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ACTIVITIES

ANNUAL EVENTS: President's Field Trip-summer. Picnic-August. Banquet-March. Annual Meeting -February,**FIELD TRIPS**: Usually one per month, via private car, caravan or chartered bus.**GEOLOGY SEMINARS**: Third Wednesday, except June, July, August. 8:00 p.m. Room S17 in Cramer Hall, PSU Library :Room S7, open 7:30 p.m. prior to evening meeting .**PROGRAMS**: Evenings: Second and Fourth Fridays each month, 8:00 p.m. Room 371. Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon **LUNCHEONS**: First and third Fridays each month, except holidays, at noon, Bank of California Tower, fourth floor, California Room, 707 SW Washington, Portland Oregon. **MEMBERSHIP:** per year from January 1: Individual, $15.00, Family $25.00, Junior (under 18) $6.00. Write secretary for membership applications.**PUBLICATIONS**: *THE GEOLOGICAL NEWSLETTER* (ISSN 0270 5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year (add $12.00 postage for foreign subscribers) Individual subscriptions at $13.00 a year. Single copies $1.00. Order from the Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207. **TRIP LOGS**: Write to same address for price list.

GEOLOGICAL NEWSLETTER

THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY
P.O. BOX 907, PORTLAND, OR. 97207

VISITORS WELCOME — VOL. 61, No.7
INFORMATION: 284-4320 — JULY, 1995

JULY ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Lunch with members in cafeteria at 11:30 AM, if desired)

July 7: Discovering the Tualatin River
Rob Baur, The Tualatin Riverkeepers

July 21: Holes for People???
Ralph Mason, ret. Director, DOGAMI; State Geologist

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

July 14: Revisions to Tyee Basin Stratigraphy. A timely and useful presentation prior to the 1995 GSOC President's Campout (August 7-13, 1995)
Gerald Black, DOGAMI

July 28: Biologic Influence on Sedimentation
Bruce Dougan, PSU Graduate Student and GSOC Scholarship Recipient

I. GEOLOGY SEMINAR FOR FIELD TRIP: 7:30 PM (Note time!) PSU, Cramer Hall, Room S-17

July 5: Rock Study for Geology Novices (Preparation for field trip)
Clay Kelleher, GSOC President; Richard Bartels, GSOC vice-president

July 8: FIELD TRIP: 8:00 AM
Walk to a Rock: A walking tour of downtown Portland buildings.
Meet in front of 1721 SW Broadway (Cramer Hall, PSU)
Led by Clay Kelleher & Richard Bartels

II. GEOLOGY SEMINAR FOR FIELD TRIP: 7:30 PM Portland State Univ., Cramer Hall, Rm. S-17

July 19: Introduction to Portland Geology (Preparation for field trip)
Richard Bartels, GSOC vice-president

July 22: FIELD TRIP: 8:00 AM
Portland Geology: Meet at Washington Park Zoo parking lot. Bring Portland street map and lunch. Led by Richard Bartels

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ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH! Write or call Evelyn Pratt, 223-2601.

1995 G.S.O.C. President's Campout August 7-14 (Mon-Mon)

Stratigraphy of the Northern Oregon Coast Range

Objective: Gain detailed knowledge of the major rock units comprising northwestern Oregon. The geographical area is roughly bounded by highways 30, 47, and 101. Tertiary units range from the Siletz River Volcanics to the Columbia River Basalt. Pleistocene formations and effects of Recent events will also be viewed. A majority of the stops will be at roadside, but a few sites are best observed with a short hike.

Administrative Leader: Clay Kelleher (home 775-6263, off 321-6239), plus three professional leaders.

Cost : **$75** Includes field trip guide, administrative fees, and group campground.

Field trip headquarters: **Anderson Park,** in Vernonia, OR, near city center. (Note change in location from June Newsletter announcement.) Park has full-time attendant, RV hookups, tent camping, cookhouse with stove, refrigerator, and tables.

Motel: Limited space available at Village Motel, 409 Rose Ave. Vernonia 97064, on west side of Highway 47 about ½ mile south of city center. Four rooms are being held for GSOC. Anderson Park attendant also has a trailer for rent. Clay Kelleher (phones above) has details on room facilities and will make all arrangements.

Schedule:

Monday, August 7,	4:00 pm: Begin assembling campsite at Anderson Park, final check-in. 8:00 pm: Campfire: "Welcome to the Oregon Country"
Tues-Thurs, Aug 8-10	8:30 am: Assemble caravan at Anderson Park, make full day's field stops, return to Anderson Park at about 5:00 pm each day. A lunch stop will occur each day, participants are responsible for their own lunches
Friday, August 11	(various times) Optional organized side trips
Sat-Mon, Aug 12-14	(same as Aug 8-10)
Monday, Aug 14	8:00 pm: Campfire: "Adieu"
Tuesday, Aug 15	9:00 am: Break camp

Registration: Make checks to Geological Society of the Oregon Country, send to P.O. Box 907, Portland, OR 97207. Acknowledgements with brief information (maps to campground, brief geological itinerary, etc.), will be sent. People wanting motel or trailer rooms telephone Clay Kelleher. If you are bringing an RV and have room for a guest, please call. Field trip guides will be ready August 4, and will be distributed at campground or first stop, but may be picked up in advance.

'SU WILL HONOR GEOLOGY EDUCATOR ALLEN

John Eliot Allen, a professor emeritus of geology at Portland State University, will receive a Presidental Citation from PSU President Judith A. Ramaley at spring commencement Saturday.

The citation will be for Allen's "outstanding service and dedication" to the university.

Allen, 86, founded the geology department at then-Portland State College in 1956 after serving 20 years a field geologist throughout the United States.

He was nationally recognized for his teaching in 1972 with the Neil Miner Award from the National Association of Geology Teachers. He also served as the association's president.

After retiring 22 years ago, he began writing about geology. His books about the Columbia Gorge and the Bretz Floods have gone through to editions. In the 1980s he wrote more than 200 les on Northwest geology for the Oregonian in a weekly column called "Time Travel.

The article on John Eliot Allen appeared in the Oregonian

COMPLETELY FRACTURED GEOLOGY

by the Pratt/Pearson/Murray families

1. **ablation**: the washing-up that monks do in the morning.
2. **Chordata**: Goddess of Music.
3. **chromate**: a black bird's wife or husband.
4. **clastic**: an arachnid in a limousine.
5. **gastrolith**: a monumental, freestanding petrified stomach.
6. **lazurite**: rocks that rise from the dead.
7. **lenticular:** similar in nature to a small, round legume.
8. **kinetic**: refers to mannerisms of relatives.
9. & 10.: **Laurasia & Laurentian**: names for twins born to geologists.

THERE IS JUST SOMETHING MAGNETIC ABOUT THE STEENS MOUNTAINS

Magnetite in the lava of the southeastern Oregon landmark shows rapid changes in the Earth's poles.

ByRichard L. Hill of The Oregonian Staff

Boy scouts on a long hike find themselves lost, their trusty pocket compasses going haywire. Magnetic north seems to be on the move, heading south.

This bizarre scenario isn't implausible as it sounds. A new study indicates the earth's magnetic field may make very rapid direction changes.

Studying ancient lava flows on stark 9,670-foot-high Steens Mountain in southeastern Oregon, scientists have found that the planet's magnetic field quickly shifted its direction 16 million years ago at a rate of about 6 degrees per day.

Earth's north and south magnetic poles have flip-flopped hundreds of times in the past. The planet's magnetic field probably has been reversing at irregular intervals for as long as it has existed, at least 3 billion years. The reasons for the switch aren't known.

It usually takes about 5000 years for a total reversal. The new findings, reported in the April issue of the journal *Nature*, suggest that the long process can be punctuated by brief episodes of very rapid change.

"You guys in Oregon can really be proud of your mountain," said Robert S.Coe, a professor of earth sciences at the University of California at Santa Cruz, who co-authored the study with researchers from the University of Montpellier in France. " It's the best record of a reversal recorded by lava flows that have been studied anywhere".

"Steens Mountain happened to be erupting lava flows quite rapidly in geologic terms when the field started to reverse. And it's is the best anyone has found so far.

As lava cools, the magnetite it contains aligns itself with the magnetic field. The researchers found sites on Steens Mountain where changes in the magnetic direction existed within a single lava flow.

"This is one special place in the reversal where it looked like the field may have moved very, very quickly, Coe said. "But you should think of it as an erratic process with the field sometimes staying relatively still, sometimes moving very rapidly, perhaps sometimes moving slowly. The whole process from beginning to end.... probably takes a thousand or a few thousand years."

Steens Mountain happened to be erupting lava flows quite rapidly in geologic terms when the field started to reverse. And it's is the best anyone has found so far.

Coe, a paleomagnetist, said the earth's magnetic field probably will shift again just as it has hundreds of times in the past. On average, the field reverses about four or five time every million yeas, he said.

"We've gone about 780,000 years since the last reversal, so it's been longer than usual since we've had one," Coe said.

What would the effect on humans be? "Well, we know that species have lived right on through magnetic reversals," Coe said. "We know that many species seem to be more capable than we of detecting the magnetic field, and some of them use it as one of the many systems of staying oriented.

"It doesn't seem like most species are so dependent on it that they die out when the field reverses."

Coe said some scientists have speculated that a reversal of the magnetic field could cause the aurora borealis to be seen in lower latitudes. And magnetic compasses may go awry, but airplane and ships use more sophisticated navigation aids now.

The article *There's just something magnetic about Steens Mountains* appeared in the "Oregonian, Saturday, April 22, 1995. Permission was granted by the author, Richard l. Hill, to publish the article in the Geological Newsletter.⊕

CORRECT DEFINITIONS FOR FRACTURED GEOLOGY

adapted from Dictionary of Geological Terms, ed. by Bates & Jackson for AGI, 1984. E. Pratt.

1. **ablation**: (1) all processes by which snow and ice are lost from a glacier. (2) removal of molten surface layers of meteorites by vaporization during flight through the atmosphere.
2. **Chordata**: a phylum of animals including those with backbones (Vertebrata) or notochords.
3. **chromate**: a mineral that contains the chromium-oxygen ion CrO4-.
4. **clastic**: pertaining to a rock or sediment made of fragments derived from pre-existing rocks or minerals, and transported some distance from the place of origin.
5. **gastrolith**: a dinosaur gizzard stone.
6. **lazurite**: an intense blue sodalite mineral, the principle constituent of lapis lazuli.
7. **lenticular**: resembling in shape the cross-section of a double convex lens.
8. **kinetic**: of, relating to, or produced by motion (Am. Heritage Dictionary).
9. **Laurasia**: during the Cretaceous Period, the large continent in the Northern Hemisphere from which today's Eurasia and North America evolved.
10. **Laurentian:** a term for granites of the Precambrian Canadian Shield.

ITS ANCIENT PAST: GEOLOGY OF THE SAWTOOTH NATIONAL RECREATION AREA, IDAHO

Geologists believe that in the very ancient past---- from 600 million to 225 million years ago--- an island sea covered most of central Idaho. With the erosion of the surrounding land, a deep layer of mudstone, sandstone, and limestone was formed at the bottom of the sea. Through the centuries, upheavals from deep within the earth, together with erosion and glaciation on the surface, have greatly changed the land, forming and shaping the peaks, hills, and valleys of the Sawtooth Country. Most of the sea-laid deposits in central Idaho are gone. Those that are left have been altered by the action of heat and pressure; they have been "metamorphosed."

In the Wood River Mountain Lands, metamorphic sediments remain. Massive blocks of these materials are left from the ancient sea. These have been folded, faulted, and uplifted by pressures from within the earth. We see the story told in the structure of the Boulder Mountains. The valley lands show deposits laid down by glacial and water actions in much later times, one million to ten thousand years ago.

To the north and west is the dramatic range of the Sawtooths. This is a line a jagged peaks that has stirred awe by visitors since the first primitive hunters followed the retreating ice to the foot of the mountains. The Sawtooths might be said to have begun with the intrusion of the Idaho Batholith into the very old Pre-Cambrian rock and the Paleozoic sedimentary rock to which we referred earlier----perhaps 110 million years ago. (A "batholith" is a large intrusion of igneous rock. If the intrusion is smaller, geologists call it a "stock." An "intrusion" is an influx of molten rock that does not break through the surface).

Adding to the complex history of the Sawtooth Mountains, is the Sawtooth Batholith----much smaller than its predecessor---which was intruded into the Idaho Batholith along a zone of weakness perhaps fifty million years ago. The rock of the Sawtooth Batholith is granitic and slightly pink. The Idaho Batholith is gray (quartz monzonite). It is hard to spot the difference. The Sawtooths were also changed by uplift when two northwest-trending f[illegible] developed---one near Atlanta and the other along Sawtooth Valley---causing further elevation of parts of these mountains. Erosion and glaciation have removed most of the sedimentary rock that once covered these batholiths.

The most easly discernible of the results of the actions of nature in the shaping of the sawtooths is probably the glacioal carving that took place in the Pleistocene age, in the last million years or so. Glaciers from successive ice ages, weighted by unrelenting snows that fed them, moved across the granite faces of the batholiths, following natural indentations, gouging out the rock in their path. This ground up rock, called " glacial till," was deposited along the sides and terminus of the glaciers . These rivers of ice ground out valleys and created the peaks. Successive glaciers widened and deepened the valleys, forming U-shaped canyons that characterize glaciated lands. The work of the glaciers can be seen in all parts of the S[illegible]oth NRA

The material on the Sawtooth Geology was taken from ***SAWTOOTH NATIONAL RECREATION AREA*** by Sawtooth National Forest, U.S. Department of Agriculture information bulletin.

THE REMARKABLE EYE OF THE TRILOBITE

The eyes of trilobites, small extinct arthropods of the Paleozoic Era, have been found to possess sophisticated, glass-like lenses capable of producing clear images over a wide depth of field.

The lenses owe their remarrkable properties to their impregnation with the mineral calcite, specifically calcite with its crystal structure arranged as precisely as to produce the optical properties of glass, says Kenneth Towe of the Paleobiology Department of the Smithsonian Institute.

The cyrstal orientation is so accurate and consistent from specimen to specimen that it must have been due to a process of biomineralization. The "calcite lenses" says Towe, "must have been present during the life of the animal.

To study optics of the lenses, Towe imbedded specimens in clear epoxy, face down on glass slides and looked at objects through the eye with a micoscope. The result was inverted images that stayed in focus from a few millemeters to optical infinity.

A few living arthropods have calcified lenses in their eyes, but their poor orientation would produce double vision.

This article about trilobites eyes was taken from THE ROCKFINDER, a rockhounds local publication.

ROCK EATERS AT WORK

The involvement of biological agents in the decomposition of rocks has attracted increased attention in recent years, particularly in the area of preserving historic structures. Scientists have found that the role of microorganism in the deterioration of stone and similar building materials has been largely underestimated.

Wilhelm Irsch reports in *Die Zeit (*Overseas edition, no. 38) on findings in Germany, where the Federal Government supports investigations by such groups as the germicrobiology research term at the University of Oldenburg. Here, geologists, biologists, chemists and physicists are collaborating in studies of the effects of the numerous organisms that attack buildings. These tiny "rock eaters" include lichens, fungi, molds, and bacteria. Thus, for instance, fungi closely related to those growing on marmalade jars have been found occurring widely on rocks; even waste-water organisms have been discovered on rocks.

The same rapid processes of decomposition that affect organic substances, for instance, the spoiling of fresh food or the rotting of animal cadavers, are applicable in the biological deterioration of minerals. The "rock eaters" attack not only stone and concrete but also glass, metals, sheet rock, paints and wall paper.

These organisms may attack building materials directly or indirectly, for instance, through acids or salts that they produce and migrate and concentrate in the stone or concrete; they may spread the same substances through the atmosphere, through ground water, or through rain or condensation moisture that migrates within building materials. Such substance include nitric, sulfuric and carbonic acids as well as organic acids. It was found that considerable effects on stone were produced not only by nitric oxides from automobile emissions but also by nitric oxides produced from bacteria that "eat" ammonium and ammonia compounds and whose origin is still a mystery. In addition, there are mechanical destructive effects, such as biological blasting and splitting through growth processes or the formation of gases and indirect effects through influences on many chemical processes that occur in the building materials even without the presence of the "little wreckers."

Because of the minute size of the microorganisms, it is hard to imagine the size of the problem these colonizers represent. For example, the Cologne Cathedral contains approximately five million stones. Microorganisms populate these stone to a depth of 5 cm from the surface, an average density of at least 100,000 bacteria per cm^3 That means that the fantastic number of approximately ten quadrillion (10^{16}) microorganisms live on--and eat from--- the Cathedral. The speed of their reproduction and their metabolic activity are beyond description.

To the microscope view of the scientist, the microflora of building-material surfaces assumes dimensions of a tropical rain forest, and large cities appear as so many "lands of milk and honey" for microbes.

Modern cities, it seems, are particularly fertile areas for rock-eating microbes. During a study of the process of colonization, it was found that the microflora of rocks brought into the city as building material increased a hundredfold within six months, from 20,000 per gram of rock material to two million.

For sources of energy, microbes use the sun as well as chemical energy from inorganic compounds or from the organic one such as coal, oil, methane, wood, protein, or paper. The microbes "menu" ranges from carbon, nitrogen, sulfur, oxygen, and hydrogen to phosphorus and various salts. Gradually, through the feasting of microbes, building materials not only lose substance but also change their chemical composition.

So far, protective substances used to preserve building material were not aimed at controlling such processes. Thus, there exists a considerable need to catch up in the study of microbial "rock eaters."The article "ROCKS EATERS AT WORK" appeared in Oregon Geology, Volume 52, Number 1, January 1989. No author was given,

The Friday Evening Meetings as well as the Wednesday Evening Seminars are in need of people to sign-up to bring goodies (cookies, cake or what ever). It is just the same few that have supplied goodies in the past. Please, those of you who enjoy the treats sign up to take your turn.

AUG 95

THE GEOLOGICAL NEWSLETTER

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ANNUAL EVENTS: President's Field Trip-summer. Picnic-August. Banquet-March. Annual Meeting -February,**FIELD TRIPS**: Usually one per month, via private car, caravan or chartered bus.**GEOLOGY SEMINARS**: Third Wednesday, except June, July, August. 8:00 p.m. Room S17 in Cramer Hall, PSU Library :Room S7, open 7:30 p.m. prior to evening meeting .**PROGRAMS:** Evenings: Second and Fourth Fridays each month, 8:00 p.m. Room 371. Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon **LUNCHEONS**: First and third Fridays each month, except holidays, at noon, Bank of California Tower, fourth floor, California Room, 707 SW Washington, Portland Oregon. **MEMBERSHIP:** per year from January 1: Individual, $15.00, Family $25.00, Junior (under 18) $6.00. Write secretary for membership applications.**PUBLICATIONS**: *THE GEOLOGICAL NEWSLETTER* (ISSN 0270 5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year (add $12.00 postage for foreign subscribers) Individual subscriptions at $13.00 a year. Single copies $1.00. Order from the Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207. **TRIP LOGS**: Write to same address for price list.

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VOL. 61, No.8
AUGUST, 1995

AUGUST ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Lunch with members in cafeteria at 11:30 AM, if desired)

August 4: The Top of Alaska
Mel Anderson

August 18: Arizona Highlights
Phyllis Bonebrake

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

Because of the President's Campout and the Annual Picnic, there will be no Friday evening meetings or seminars in August.

****

PRESIDENT'S CAMPOUT: STRATIGRAPHY OF THE NORTHERN OREGON COAST RANGE

Monday, August 7, we meet at Anderson Park campground near the center of Vernonia, OR. President Clay Kelleher has assembled 3 top-flight professionals to guide this trip. The campout cost is only $75, since you will be responsible for your own food, gas, and lodgings. Most starting places are close enough to commute to, but it'll be easier and more fun to join fellow GSOC'ers in the fully-equipped campground or in nearby motels. Last day is Monday, August 15. THIS SHOULD BE A MEMORABLE CAMPOUT; DON'T MISS IT! Call Clay Kelleher, 775-6263 (home) or 321-6239 (office), for information and signup.

****

ANNUAL PICNIC: 6 PM Friday, August 25, at Alpenrose, 6149 SW Shattuck Rd. Call Richard Bartels, 292-6939, before August 24 to ask about or let him know what you can bring to the potluck.

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH! Write or call Evelyn Pratt, 223-2601.

FRACTURED GEOLOGY

by the Pratt/Pearson/Murray families

1. **alidade:** a square dance call, as in "Alidade left with your left hand..."
2. **augite**: mythical stables known for their large size, hence "Hercules was supposed to clean the Augite stables."
3. **cataclasis**: a method of classifying felines.
4. **chitin**: a Southern dish made with pig parts that you'd rather not know about.
5. **chrysoprase**: accolades for Chris.
6. **thermocline**: term used for country singer Patsy's vocal warmups.
7. **tonalite**: glow-in-the-dark polish for toenails.
8. **truncate**: an excuse similar to what kids use for lost homework: "The truncate our last-year's sweatshirts."
9. **hypersthene**: a complete culture-vulture.
10. **hydrostatic** head: the feeling that allergic people have during hay-fever season.

CORRECT DEFINITIONS adapted from Dictionary of Geological Terms, ed. by Bates & Jackson for AGI, 1984. E. Pratt. Page 45

TSNAMI SURVEY CONDUCTED BY DOGAMI

by Angie Karel, Oregon Department of Geology and Mineral Industries.

The Oregon Department of Geology and Mineral Industries (DOGAMI) is becoming increasingly concerned about the risk to people and property posed by large offshore earthquakes that can be expected to result in damaging tsunamis ("tidal waves").

The department was interested in determining if any type of tsunami preparedness education or evacuation drills were currently being taught in Oregon coastal schools. Proposed survey questions were developed by Department staff and peer reviewed by Al Shannon, Oregon Department of Education; Sherry Paterson, Earthquake Prepardness Network; and Peg Reagan, Curry County Commissioner serving on the Seismic Safetv Policy Advisory Commission. In August 1994, tl tsunami survey was mailed to school principals in 96 selected Oregon coastal schools in Clatsop, Coos, Curry, Douglas, Lane, Lincoln, and Tillamook Counties. Responses were received from 39 schools(41 percent).

Of the 39 schools that responded, 16 stated that some form of tsunami preparedness is currently taught in all grades K-12. Survey responses indicate that grades 6,7, and 8 receive slightly less tsunami preparedness education than grades K-5 or 9-12.

Teaching methods and material varied from school to school. Responses indicate that tsunami preparedness is generally taught during science class or in conjunction with earthquakes preparedness education. Tsunami evacuation area include "small hill away from the school," "next to the school," "in front (east) of the school" "up the mountain," or "to higher ground." Tillamook County has a county-wide warning system that is revved as part of the school' preparedness training. Teaching materi include earth-science curriculum materials, building-safety plans, teacher-prepared materials, information obtained from the Red Cross and Oregon State University, a tsunami handout provided by Clatsop County, and local information received from emergency government agencies.

Schools were asked to list teaching materials that would be beneficial in relation to tsunami preparedness. Generally, schools suggested that any type of information on tsunami hazards would be beneficial for them as they prepare an education plan. for them as they prepared an education plan. Specific information on timing and alternate escape routes, off school property, was also suggested as beneficial.

Of the 39 schools that responded, only 15 practice tsunami evacuation drills during the school year. Seven of the schools conduct tsunami drills monthly, while other schools conduct dri bimonthly, two times a year, or yearly. Documentation of tsunami drills are being conducted at the same time as earthquake drills in 12 schools. Of those 12 schools, 8 evacuate to high ground or go to an inland location off the school grounds. Limited responses were received for questions relating to evacuation routes, evacuation drills and differences between tsunami drills and earthquake drills.

A total of 19 schools expressed interest in receiving training on how to conduct a tsunami evacuation drill, and 17 schools were not interested in receiving training.

Schools were asked whether a local workshop on tsunami hazards for teachers would be beneficial.. Fifteen schools were not interested in a local workshop on tsunami hazards. From the 13 schools where it was felt that a workshop would be beneficial, topics suggested included presentation of factual information on tsunami hazards, an overview of procedures for classroom instruction and evaluation drills, inland impacts, safety issues, and information on age-appropriate curriculum materials.

A copy of the tsunami survey results was requested by 22 schools. A complete set of survey responses will be maintained at the Portland office of the Oregon Department of Geology and Mineral Industries. For further information contact the Oregon Department of Geology and Mineral Industries, 800 NE Oregon Street, Suite 965, Portland, Oregon 97232, phone 503-731-4100, FAX 503-731-4066.

The article TSUNAMI SURVEY CONDUCTED BY DOGAMI, appeared in Oregon Geology, Volume 57,Number 2, March 1995, p. 31.⊕

CORRECT DEFINITIONS FOR FRACTURED GEOLOGY

1. **alidade**: a straight-edge rule with telescopic sights, used in surveying for mapping.
2. **augite**: a dark pyroxene mineral found in many basic igneous rocks.
3. **cataclasis**: rock deformation by fracturing and rotation of mineral grains.
4. **chitin**: a cellulose-like organic compound, part of the outside skeleton of arthropods such as crabs and insects.
5. **chrysoprase:** apple-green, gem-quality chalcedony.
6. **thermocline**: the layer where, when descending through a body of water with layers of differing temperature, the water cools most quickly.
7. **tonalite**: quartz diorite; the intrusive equivalent of a quartzy andesite.
8. **truncate**: in crystals, to replace the corner of a crystal form with a plane.
9. **hypersthene**: a common rock-forming mineral
10. **hydrostatic head**: the height of a column of water, the weight of which equals the pressure at a given point.

TRIASSIC TRACKS TRIGGER DIG ON PRISON GROUNDS

by S. Welch

An ordinary day turned eventful for prison inmate Wayne Covington when he unearthed a section of the largest dinosaur trackway ever discovered in Pennsylvania. The trackway is located on the grounds of Graterford Prison, outside of Philadelphia. The inmate, employed by the facility's dairy farm, had just finished his rounds checking cow fences when he took a shortcut through a ravine. As he passed by a shale outcropping along the ravine wall, he struck it with his fence-mending hammer and the rock split open, revealing a perfect, three-toed footprint of a 220-million-year-old dinosaur.

The fossilized footprint (ichnite) trackway was examined by Dr. Robert Sullivan, Curator of Paleontology and Geology at the State Museum of Pennsylvania, who determined the creature might be Coelophysis, a small, sharp-toed, meat-eating dinosaur that walked on its hind legs. A trackway of this size can contain enough footprints to allow paleontologists to study how the dinosaurs moved through the area and learn something about their behavior.

Dr. Sullivan and other staff from the State Museum, along with Bill Kochanov, a geologist from the Pennsylvania Geological Survey, joined several others of the prison staff members and inmates in excavating large pieces of the track way for removal to Harrisburg, where the **ichnites** will be studied and exhibited. Prison officials have supported the inmates participation in the dig, saying the men "feel they are making a contribution to society by discovering these prints and sharing them with others."

SOURCES:
Cass, J., " A Triassic find at Graterford" : The Philadelphia Inquirer, issue for Subday, July 23, 1994, Philadelphia, Pennsylvania.

Sullivan, R.M., Randell,K., Hendricks, M., Kochanov, W.E., 1994, The Graterford dinosaurs--tracking Triassic travelers: Pennsylvania Geology (in press).

The article on Triassic Tracks appeared in LITE GEOLOGY, a quarterly publication for educators, Winter, 1994. New Mexico Bureau of Nines and Mineral Resources.⊕

As the President's Campout will center at the town of Vernonia I have included with this Newsletter excerpts from an article by Margaret Steere on fossil locations close to the President's study area. Dot and I have dug at most of these locations pictured on the map at the end of the article. Ed.

FOSSIL LOCALITIES OF THE SUNSET HIGHWAY AREA, OREGON

by Margaret L.Steere

The following information contains excerpts from Fossil Localities of the Sunset Highway, Reprinted from the Ore Bin, Vol. 19, no. 5, p. 37-44, later published in *FOSSILS IN OREGON*, Bulletin 92, DOGAMI. The locations and description of fossils to be found are in the complete article.

The Sunset Highway area in western Columbia and Washington Counties, Oregon, is famous for its abundant marine fossils of Oligocene age. The fossiliferous area lies about 35 miles northwest of Portland and extends from Mist at the north end to Forest Grove at the south. Outcrops yielding fossils are numerous, and most exposures of sedimentary rock, hard enough to resist weathering, reveal at least a few fossils. The localities described on the following pages, are easily reached by road. Sunset Highway (US 26) bisects the area and surfac roads lead north and south from it.(Page 47)

GEOLOGIC SETTING

During most of the period from late Eocene until the end of Oligocene time, some 30 to 50 million years ago, northwest Oregon was covered by an arm of the sea in which mollusks and other marine invertebrates were exceedingly numerous. Steams eroding the adjacent land brought in mud, sand, and volcanic ash which settled in layers on the floor of the sea. As the floor gradually subsided, thousands of feet of sediments accumulated. Shells of animals living on the sea bottom, or washed up along the margins, were buried and preserved as fossil in the sedimentay rocks.

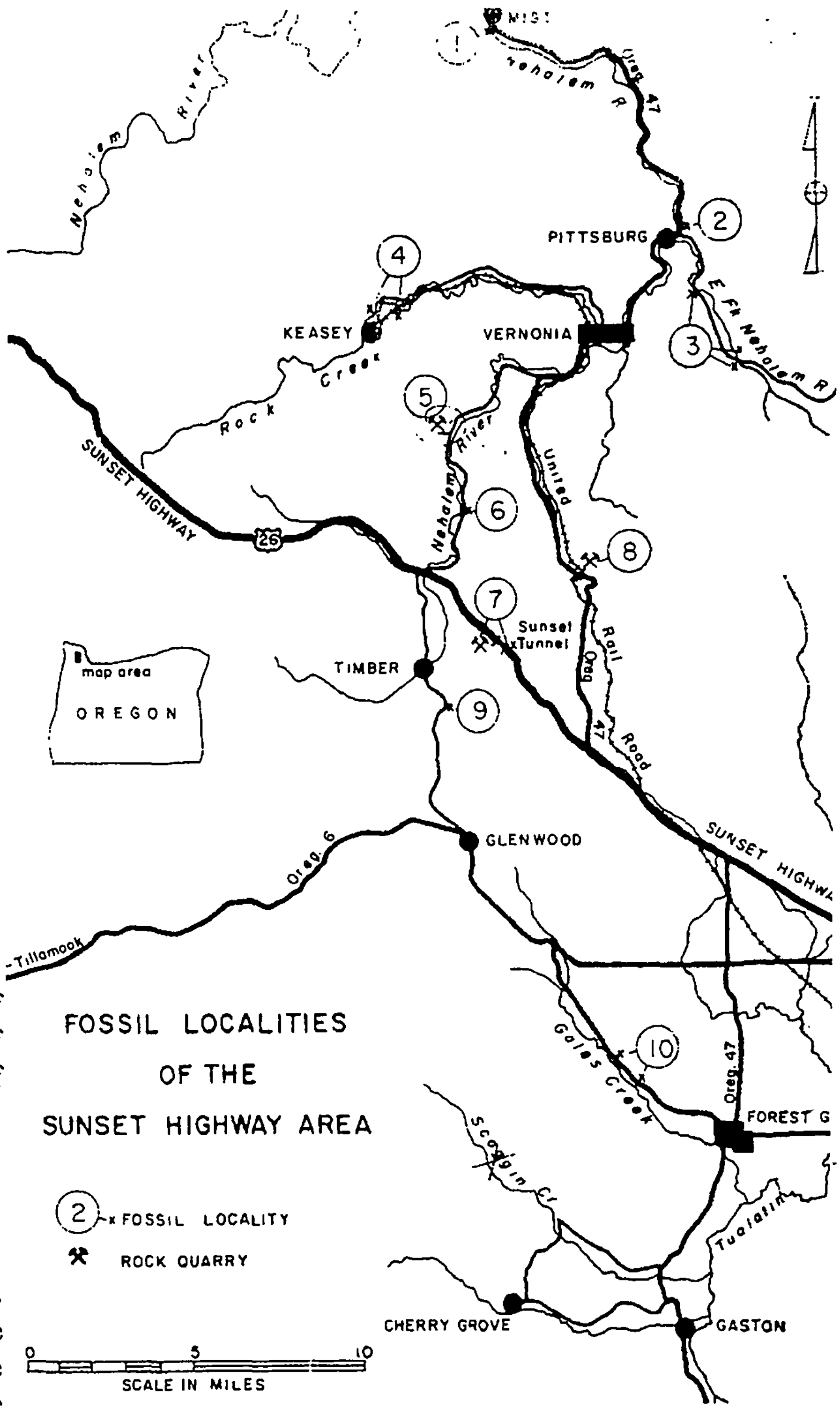
Sometime after the close of the Oligocene period, the land was uplifted permanently from the sea and the sedimentary rocks were warped into gentle folds and then deeply eroded. Today these tilted fossil-bearing strata are exposed in steep banks along steams and in roadcuts and quarries.

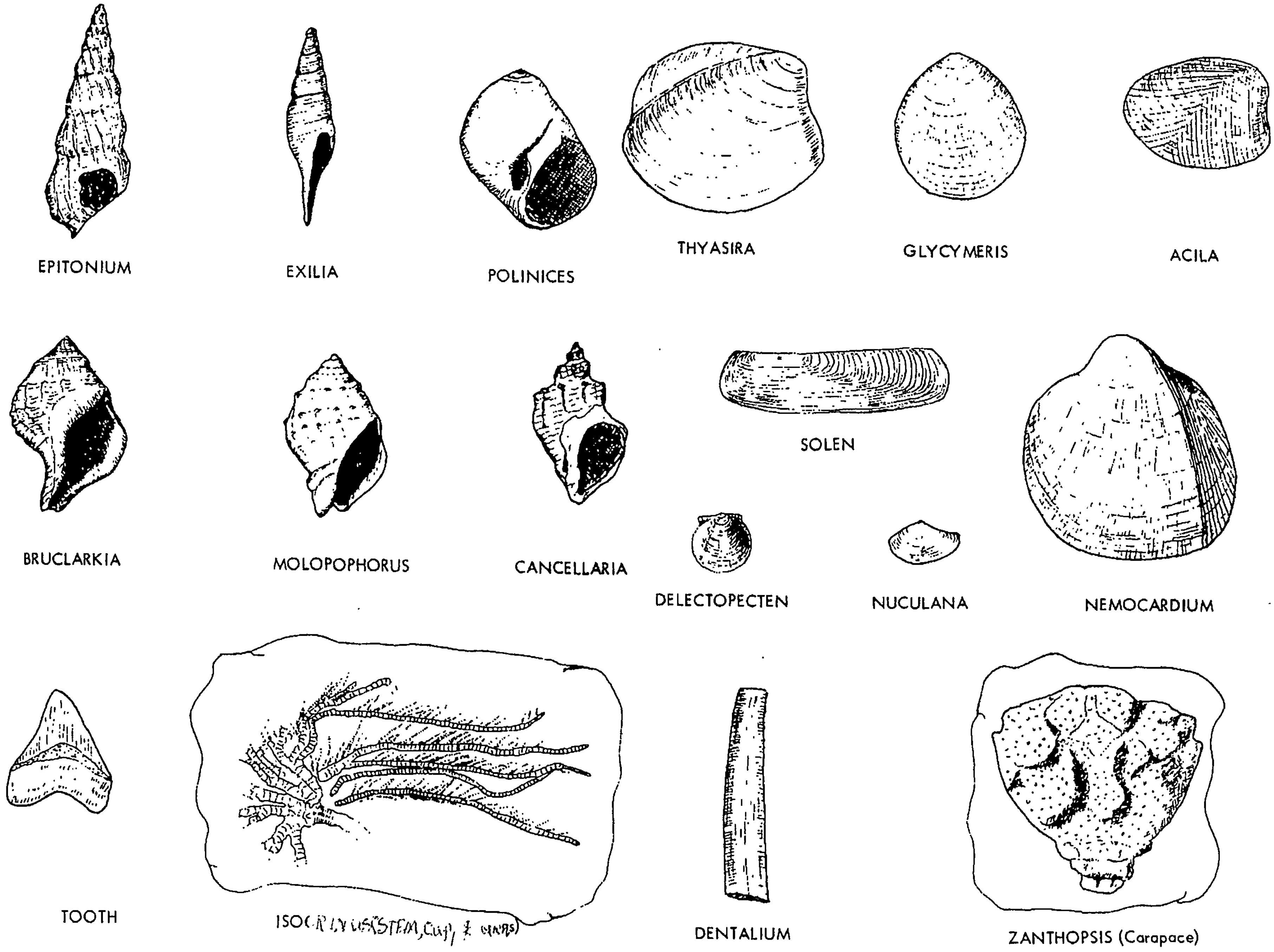
The oldest fossiliferous sediments in the area belong to the Cowlitz Formation (upper Eocene) , which in the region of the Cowlitz River, Washington, rea[illegible] a thickness of 8,000 feet. In Oregon, the Cowlitz Formation is less extensive and consists of largely of conglomerates and sandstones deposited near the shore of the Eocene sea. These rocks crop out irregularly along the western side of the Sunset Highway area, where they overlie or interfinger with volcanic rocks of the Coast Range. Some outcrops of the Cowlitz Formation contain marine shells and others show fossil plant remains.

Overlying the Eocene sediments are the highly fossiliferous Oligocene marine formations. Most noteworthy of these, as far as abundance and variety of fossils is concerned, are the Keasey and Pitttsburg Bluff Formations (named after Keasey and Pittsburg in Columbia County where the formations were first studied. The Keasey Formation, which is the older of the two, is about 2,000 feet thick. It is, for the most part, a massive tuffaceous mudstone which is gray on fresh exposure but turns soft and yellowish when exposed to the weather. It outcrops between Ke[illegible]y and Vernonia, and contains a wide band tre[illegible]ng north and south through the center of the map area . Fossils are found in most unweathered outcrops (localities 1, 4, 6, 7, 8, 9, 10) and include many new species, some recently described by Hickman (1976).

The Pittsburg Bluff Formation is a massive sandstone about 800 feet thick containing richly fossiliferous layers. It is exposed in various places from the bluffs along the Nehalem River north of Pittsburg to outcrops along Sunset Highway east of the tunnel. It is most fossiliferous in the vicinity of Pittsburg (localities 2 and 3) where the fossils are typical of a near shore or shallow-water fauna. Layers of plant remains, carbonaceous material, and coal are characteristic of the Pittsburg Formation

Both the Keasey and the Pittsburg Formations contain hard limy concretions ranging from the size of a baseball to 3 or more feet in diameter. These co[illegible]retions are difficult to break open, but are us[illegible]ly worth the trouble as most have something of interest inside, such as carapace of crab or a beautifully preserved shell.⊕





SOME TYPICAL FOSSILS OF SUNSET HIGHWAY AREA
(Approximate natural size)

SEP 95

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VOL. 61, No.9
SEPTEMBER, 1995

SEPTEMBER ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Lunch with members in cafeteria at 11:30 AM, if desired)

Sept 1: Start of Labor Day weekend - no meeting

Sept. 15: Geology of Nova Scotia
Rosemary Kenney

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

Sept. 8: The Kobe Earthquake
Roger McGarrigle, VLMK and Chairman of the Oregon Seismic Safety Policy Advisory Commission

Sept. 22: The Building Stone Industry of Northern Italy
Ron Geitgey, DOGAMI

GEOLOGY SEMINAR: 8:00 PM. Portland State Univ., Cramer Hall, Rm. S-17

Sept. 20: Introduction to the 1995-96 Seminar Series
Richard Bartels, GSOC V. P.

This year's seminar series will utilize the Fourth Edition of "Geology of Oregon" by Orr, Orr, and Baldwin. During the series, various GSOC members will give presentations on the geology of one of the eight physiographic provinces in Oregon that they have selected.

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH! Write or call Evelyn Pratt, 223-2601.

COMPLETELY FRACTURED GEOLOGY WILL BE IN THE NEWSLETTER IN THE OCTOBER 1995 ISSUE OF THE GEOLOGICAL NEWSLETTER

RECENT ERUPTIVE HISTORY OF MOUNT HOOD

GSOC program by Ken Cameron, Oregon geologist, April 7, 1995 (write-up by E. Pratt)

By any standards - past eruptions, present status, possible future activity - Mt. Hood is an active volcano. Its igneous core is around 1/2 million years old. The youngest dated lava flows, roughly 120,000 years old, are exposed in a ridge on the north side called The Pinnacle. Crater Rock resulted from volcanic activity on the south side of the mountain during the last 12,000 years. In the 1800's ash clouds and "fire" were seen from the valleys below. The March 1907 National Geographic magazine reported "incandescent rocks and ash" on Mt. Hood. Hot areas on and earthquakes in the mountain increased during 1987-90, but for now, at least, the mountain it is quiet.

When the Palmer lift was being built above Timberline Lodge, an additional tower was planned beyond the ones that are there now. But drilling down revealed glacial ice. Evidently an older glacier had been buried under volcanic debris during fairly recent eruptive activity. Enough of the ice is still there so that construction of the tower had to be abandoned.

Volcanoes have differing styles and frequencies of eruptions. Stromboli in Sicily explodes violently. Hawaiian mountains are built up with relatively quiet lava flows. Mt. Hood's eruptive mode is in between these types. It enlarges its dome, which then collapses and produces pyroclastic flows and mudflows. [Worldwide, mudflows are the kind of volcanic activity which has produced the greatest loss of human life. EP] Mudflows have rushed down th^ Sandy River many times. During the last erupti episode one of them stretched from Crater Rock to Troutdale, and helped make the Sandy River delta. Because of it, the Columbia River north of the delta is only 1/2 mile wide. Other mudflows came down the White River to the Deschutes at Tygh Valley.

The center of a mudflow travels fast while the sides go more slowly. Unlike flowing water which spreads out as it slows down, a mudflow stays where it is. Trees along its sides get partly or completely buried and die. Their wood can be used to carbon-date the event. The Timberline mudflow happened 1200-1500 years ago; Zigzag, 350-500 years ago; and Old Maid, 1790-1810 AD. Lewis and Clark explored the "Quicksand River" (Sandy) in 1805 and 1806, very soon after the Old Maid mudflow, and reported that it was "6 inches deep and 300 feet wide." Portland's water supply is carried from Bull Run Reservoir by six-foot-diameter pipes that cross the Sandy River at Dodge Park. The pipes are sitting on mudflow deposits. Volcanic activity on Mt. Hood would definitely endanger our water supply.

When will Mt. Hood erupt again? Are v asking for a forecast or a prediction? Forecasts give general trends - Mt. Hood generally has "events" every 200-300 years. A prediction - "It will erupt next Thursday" - is a lot harder to make. The mountain must first be in a mode. The easiest way to predict is by looking at a seismogram. Three seismographs located on Badger Butte, Tom Dick and Harry Mt., and near Lawrence Lake triangulate the location of earthquakes in Mt. Hood. If they indicate that magma is rising under the mountain, we may have a problem!

Magma uses a lot of energy to rise. This translates into earthquakes. Mt. Hood averages 20-30 earthquakes a year, although sometimes there'll be a swarm of 20-30 in a few days. The mountain's seismic zone passes right under the Mt. Hood Meadows ski area. There seems to be a 2-3 km sphere, 4-5 km below the peak, which is aseismic. An area that earthquake waves will NOT travel through indicates magma that is completely liquid. The bottom of the sphere cools, hardens into solid, ai cracks. This can produce earthquakes. The whole chamber is probably left over from Mt. Hood's last eruption.

Before Mt. St. Helens' eruption in 1980, not much volcanic monitoring was done in the Cascades. Now, of course, the monitoring is quite extensive. Seismic data from Mt. Hood goes to the U. of Washington's Seismology Lab. In 1984 Mt. Hood was measured by laser to see if it was swelling. It hasn't been measured since, and probably should be. Mt. Rainier, considered more dangerous, gets measured once a year. Anyway, there should be some warning before an eruption. One monitoring system is called the "P-Picker Program." If a computor picks up P-waves (Primary or compressional waves, the first to arrive from an earthquake), it immediately alerts a human.

Today, field work in the natural sciences is decreasing because so many people receive information via computer modeling. Some things, though, can only be learned by going out and getting your feet muddy.

Crater Rock is a dacite dome. Coleman Glacier butts up against Crater Rock on the northeast side, and steam from the vent keeps a hole open there.* The Hot Rocks are just west of the dome, and Devil's Kitchen, to the east. I map heat in the Devil's Kitchen fumarole field. There are many mounds a couple of meters across by one meter high, almost solid sulfur, with gas vents in the middle. The whole field is about 400 feet across. As the magma below cools, volatiles are given off. Water vapor, sulfuric acid and hydrogen fluoride have turned volcanic ash around the vent to sticky gray clay. In one place it's 150 degrees F. In the 1930's Dr. Allen cooked a can of beans on this spot. When I camp by the fumarole field I can roll my sleeping bag out on a warm place, bury food in a plastic bag in a hotter spot, and have a meal cooked and ready to eat in a couple of hours. But there are disadvantages. The warm hydrogen fluoride from the vent is such a strong acid that I can't wear glass glasses, because after a few months they'd be so frosted that I couldn't see through them. Ultraviolet filters are needed to protect my camera lenses.

Historically, the March 1907 National Geographic talks about "incandescent rocks and ash" on Mt. Hood. Hot areas on, and earthquakes in the mountain increased in 1987-90. Then in 1991 everything shut down.

Pictures taken in 1894 and in 1912 show that ice on the south side has retreated. Devil's Kitchen is now snowfree year round. In 1874 White River Glacier extended from the 11,000-foot-plus summit down to the 5500 foot level. Since then the glacier has lost 200 feet thickness of ice, which has split it in two. Now there's Coleman Glacier, Devil's Kitchen and White River Glacier. Devil's Kitchen cuts off the White River Glacier's zone of accumulation. There are more glacial outbursts than there used to be, and the bridge to Mt. Hood Meadows has been taken out six times. This glacier is receding much faster than any other in the Cascades.

What about the future? Will Mt. Hood erupt in five years (probably not) or in fifty (quite likely)? The only thing we can be sure of is that, like the other glaciated volcanoes in the Pacific Northwest, it will change from what we see today into - who knows?

*In 1934 a man decided to crawl down into the vent to see what was inside. He suffocated from lack of oxygen.⊕

MANUFACTURED GEMSTONES
by Duane Kinsley

Man-made gemstones have been around for a long time in one form or another. For instance, recovery of Egyptian objects as far back as 4700 B.C. gives solid evidence of their gem-making skills. Beads and pendants were made at that time of a substance called "faience" (fayenns') consisting of an inner core of powdered quartz grit covered with a layer of colored glass-like glaze. The process was later copied in making pottery, wall tiles, etc. in Faenza, Italy -- hence the name. And this sounds like the same process we use today in making ceramic bola tips, glass beads, etc. with propane flame and powdered glass. Then shortly after 1600 B.C., some 31 centuries later, the Egyptians developed true glass, and used that for jewelry. (That seems like a pretty slow progress, but its gets tough to high heat with just camel dung and slaves waving palm-leaf fans.

Today, we have all the colors and kinds of glass anyone could want for jewelry making. But they all fail, without exception, in one crucial characteristic-- they are too soft to stand up to continued wear. They get scratched, the edges wear and get chipped, and the whole "stone" soon become dull and unattractive.

In an attempt to improve the quality of gem imitations, many ingenious kinds of composite gems have been devised. By cementing or fusing together pieces of natural stones and imitation or substitute materials, more acceptable gemstones can be produced. For instance, a cap of harder material like garnet can be fused to a glob of colored glass. Then the assemblage can be cut and polished with the garnet portion on the table, or on the top of gem. With a thin plate of garnet, the garnet color doesn't show, but the entire doublet assumes the color of the glass underneath. There are opal doublets and triplets, and many other gem combinations using the same general idea. The results are often superior to the original in hardness, and are certainly more affordable than the solid natural stones that they imitate.

There are reconstructed gems such as remelted fragments of the natural stone. For instance, ruby grains heated to about 1800 ^{0} C. will soften and weld together, and can be cooled to form a single solid mass. Unfortunately, the high heat drives off the chromium and the red color is lost. But as early as 1837, a Frenchman, Marc A.A. Gaudin discovered that all it took to restore the red color was to add green chromic oxide to the melted ruby material before it cooled. Thus, many of these so called "Geneva Rubies: were made and sold. Eventually, the deceit was discovered, whereupon nobody would buy them, the market collapsed, and no one has tried to make them commercially for nearly 100 years now, according to Desautels.

Reconstructed amber has been more successfi' In the recovery and mining of amber, many piec were recovered that are too small for commercial use. These can be remelted in a hydraulic press at about 180 ^{0} C. in the absence of air. The remelted material has both the appearance and characteristics of untreated amber.

Desautels reports that attempts to melt or fuse together small fragments of emerald or other colors of beryl have resulted in a true glass, with less weight and hardness than the original beryl. Though this glass can be appropriately colored, the product make only a fair or unsatisfactory substitute, because of its relative softness.

By far the most satisfactory manufactured gems are the "synthetic" gems. It is wrong to think of them as substitutes, because they are usually identical in chemical composition to the natural stone, and are often larger and more perfect in internal structure.

Once the idea that gemstones were made of a combination of chemical elements other than earth, air, water and fire, the door was opened to the possibility of making them in the laboratory. Imagine the rush to make gold, rubies, or diamonds in the t tube. In perhaps hundreds of dimly lit shops and laboratories throughout the civilized world, I can imagine "mad scientists" grinding, mixing and heating acids and alkalies and metal powders and secretly recording the results.

Hautefeuille and Parry of France were credited with producing the first true emeralds in 1888. Their tiny crystals were made by heating the appropriate raw materials for fifteen days at a temperature of 1480 ^{0} F., then slowly cooling the container. The emeralds were excellent , but much to0 small for gem purposes. The great breakthrough came in 1891, when August Verneuil, a French chemist and his partner E. Fremy, building on the work of Feil and Gaudin, secretly invented the flame- fusion process of making rubies. They filed sealed papers with the Academy of Sciences in Paris, giving full details of the process. Eleven years later, in 1902, Verneuil published the contents of his secret papers, and the synthetic gem industry was born.

The Verneuil machine was an upside-down torch ‹ ıgement, fueled by hydrogen and oxygen burning at 2200 ^{0} C. Through this flame was dribbled (and this is important), not ruby dust, but the basic ingredients of rubies: powdered aluminum oxide and a small amount of chromium oxide for color. The melted material was then deposited, not as a blob or a glass, but as a true crystal on a holder below the flame. The resulting crystal is called a "boule".

Because rubies and sapphires are different colors of the same material (Corundum) the process can also grow sapphire boules. Without the chrome oxide, a colorless sapphire is produced. With a tiny amount, pink sapphire; a moderate amount--red ruby; and a large amount, believe it or not, a green sapphire, according to Desautels. He also states that manganese makes the sapphire pink; nickel, yellow; and titanium plus iron, the popular rich blue.

Synthetic sapphires and rubies were made in Switzerland, France, and Germany until 1940, when the Line Air Products began manufacturing them in the U.S. They were highly successful, and the output was critical to the war effort. Because of the h ıess of 9, a large volume of synthetic corundum is used in industry for abrasives, jet orifices, instrument and watch bearings, etc. Eventually, the company even developed star rubies and sapphires by adding titanium, which formed tiny rutile crystals to produce the star effect. Today the Verneuil system is also used to produce spinel, titanium dioxide (Titania), and a material unknown in nature--strontium titanate (Fabulite and other trade names.)

Two other crystal growing techniques have been developed. They are the flux-fusion method and hydrothermal method. Flux-fusion involves heating the required chemicals in some sort of a chemical solvent or flux, slowly cooling, then removal of the flux by dissolving in acid. Hydrothermal employs water solutions, usually under very high pressure and temperature. Large quartz crystals are grown in this way.

Other synthetic gems are in production, or are actively being developed, not only for the gem trade, but also for industry. For instance, diamonds are b grown in quantity for industrial purposes. Small crystals of alexandrite and other chrysoberyl, zircon, and garnet materials have already been grown by fusion. And perhaps we are all familiar with the brilliant yttrium aluminum garnets (YAG). Synthetic gems are usually more affordable and often superior to the natural stones they replace.

Bibliography: "THE GEM KINGDOM" by Paul E. Desautels, Random House; "DANA'S MANUAL OF MINERALOGY", John Wiley & Sons, Inc.; and the :ENCYCLOPEDIA AMERICANA", American Corporation.

The article "MANUFACTURED GEMSTONES appeared in Northwest Newsletter, the Official Publication of the Northwest Federation of Mineral Societies, Vol. XXXIV, No. 11, July 1995.⊕

NINETY DAYS (and nights) IN THE EMERGENCY ROOM

as a receiving room orderly

by Dr. John Allen

Last night I watched for the first time the hit TV program "ER", which is all about what the writers think goes on in and around the emergency room at a hospital. I was not entertained by the shenanigans of the nurses and interns, and doubt if I will ever turn it on again. It did remind me , however of three very interesting months that I spent working in a hospital!

On my *wanderer* in 1928-29 I visited relatives in Milwaukee, Wisconsin during the fall and winter. My aunt Amy got me a job as a receiving room orderly in the Milwaukee County Emergency Hospital, only a few blocks from the Allen's home. It paid $35 a month "and found") which meant food and lodging), with hours "12-0n and 12-off. This salary amounts to less than 20 cents an hour for an 180-hour month.

On my "day-off", I had time to visit the Allen family, spent time reading in the Milwaukee Public Library, and, and most interesting of all, accompany the hospital ambulance on its runs. I don't remember having any trouble in adapting to the weird 12 hour schedule, or losing or needing more sleep.

Stangely enough, I remember absolutely nothing of the hospital dining facilities, of the room where I must have slept from time to time, but have all too vivid pictures of the long tile-floored hall, the receiving room and the five waiting rooms that made up the ground floor of the emergency wing of the hospital.

I spent much of my time mopping these floors during that cold and wet winter - I kept the bucket and mop behind the entry door, so that I could follow each trail of muddy footprints down the hall and mop them clean. But I also needed to mop the receiving and waiting rooms several times during my 12-hour stint, when patients or visitors tracked in mud or became sick and made messes.

Fortunately, this chore was only incidental to my helping the lone attending nurse with whatever she asked me to do. The routine went something like this: the ambulance, police car, taxi or private car would arrive with a patient, and I would dash out with a gurney, in case it would be needed, and helped the patient into the receiving room.

The nurse and I would first see to any critical needs of the patient, and phone as soon as we could to tell the intern on duty that day that he was needed. Once in a long while he would be down in a few minutes, more frequently it was ten to twenty minutes before he arrived.

During this interval, I can remember helping the nurse administer artificial respiration to restore breathing, strapping the patient down on the operating table or putting him in a strait-jacket to keep his convulsions from hurting himself., cutting off parts of his clothing to expose the injury, applying pads to stop the bleeding, and otherwise preparing the patient for treatment by the doctor when he arrived.

Remember, in 1929 there were no electronics - no heart monitoring displays, no shock appliances to restore heartbeat, and no oxygen bottles. Just cabinets containing operating tools, hypodermics, bandages, tapes, anesthetics (in those days it was either chloroform or ether). After preliminary treatment by the doctor, I sometimes helped the patient onto a gurney and took him upstairs to the main operating room.

After the arrival of the intern I was seldom needed in the receiving room, but by then I frequently had take care of the weeping or hysterical family members who had come in with the patient - take them into the waiting room, calm them down, offer them coffee, and sometimes lock them in. Several times I had to take care of drunks, sometimes had to call the police.

Two especially memorable events span the gamut from humor to tragedy. During an especially severe cold spell (16 degrees below zero) we had several women come in wearing fur coats that they had not been able to hold together in front to keep their breasts from being frost-bitten. The other case was a carpenter who had fallen three stories, and had broken many of his bones and cracked his skull; I don't remember whether he survived, but it gave us a strenuous hour in the receiving room.

When I had saved enough to buy a bus ticket to New York, I announced that I was leaving, and head nurse told me that if I ever again wanted a job in a hospital, she would be glad to give me a recommendation.⊕

FREE GUIDE TO OREGON MUSEUMS

A free 1995 Pocket Guide to Oregon Museums has just been published by the Oregon Museum Association, the Historical Society, and museums throughout the state. It lists locations, hours, general contents, and admission charges, if any, of over 130 museums. The guide tells you where you can find out about Oregon's history, art, geology, wildlife, plants, natural resources, and industries and which museum has handson displays and activities where you can learn by doing. The guide is available at most Oregon museums. Single copies may be obatined by sending a self-addressed, stamped, legal -size envelope to the Nature of the Northwest Information Center, 800 NE Oregon Street #5, Portland, OR 97232.

WATCH FOR A COMPLETE REPORT OF THE PRESIDENT'S CAMPOUT THAT WAS HEADQUARTED AT ANDERSON PARK IN VERNONIA IN THE NEXT ISSUE OF THE NEWSLETTER TO SEE THE GREAT THINGS YOU MISSED.

NOV 95

THE GEOLOGICAL NEWSLETTER

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GEOLOGICAL NEWSLETTER

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VOL. 61, No.11
NOVEMBER, 1995

NOVEMBER ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Lunch with members in cafeteria at 11:30 AM, if desired)

Nov. 3: Stratigraphy of the N. Oregon Coast Range (President's Campout), Part I
Clay Kelleher, GSOC President

Nov. 17: Stratigraphy of the N. Oregon Coast Range, Part II
Clay Kelleher, GSOC President

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

Nov. 10: Stratigraphy of the N. Oregon Coast Range, Part II
Clay Kelleher, GSOC President

Nov. 24: Thanksgiving Holiday - no program

GEOLOGY SEMINAR: 8:00 PM. Portland State Univ., Cramer Hall, Rm. S-17

Nov. 15: Klamath Mountains: A Geological Jumble. Seminar leader: Evelyn Pratt. Please read Ch. 3, pp 51-78 in Orr, Orr & Baldwin's Geology of Oregon, 4th Ed., before coming to seminar. (Text on pp. 51-52 and diagram on p. 52 are especially helpful.)

DUES ARE DUE------DUES ARE DUE

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH! Write or call Evelyn Pratt, 223-2601.

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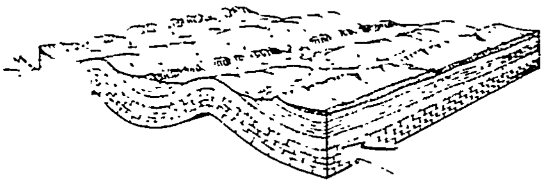

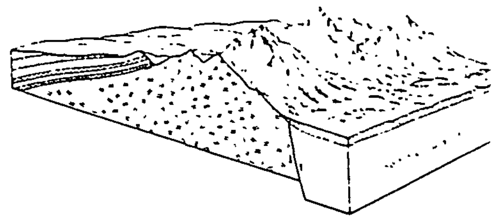

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February

FIELD TRIPS: Usually one per month, via private car in caravan, or chartered bus.

GEOLOGY SEMINARS: Third Wednesday, except June, July, August. 8:00 pm, Rm. S17, Cramer Hall, PSU. Library: Room S7, open 7:30 pm prior to meetings.

PROGRAMS: Evenings: Second and Fourth Fridays each month, 8:00 pm, Rm. 371, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland.

LUNCHEONS: First and Third Fridays each month, except holidays, at noon. Bank of California Tower, 707 SW Washington St., 4th floor Cafeteria, California Room.

MEMBERSHIP: per year from January 1: Individual - $20.00; Family - $30.00; Junior (under 18yrs.) - $6.00. Write or call Secretary for membership applications.

PUBLICATIONS: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations $10.00 per year. Individual subscriptions $13.00 per year. Single copies $1.00. Order from Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207.

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DUES ARE DUE BY DECEMBER 31 ******

********DUES ARE DUE BY DECEMBER 31

COMPLETELY FRACTURED GEOLOGY

by the Pratt/Pearson/Murray families

1. **fluvial:** pertaining to a sickness caused by a virus.
2. **emergent:** when you have one, call 911.
3. **downdip block**: H&R's mentally ill brother.
4. **declination:** a statement - i.e., the Declination of Independence.
5. **crossed nicols**: two angry coins in a small change purse.
6. **collimate:** long-furred dog's spouse.
7. **laterite**: not now; as in "We'll do it later, rite?"
8. **littoral**: not subtle.
9. **pelagic**: refers to the condition of an individual lacking Vitamin B (niacin).
10. **rutilated**: firmly planted.

THE SEVERITY OF AN EARTHQUAKE

Interest in earthquakes in Oregon has been spurred recently by the hypothesis that the Juan de Fuca Plate may subduct beneath Oregon and Washington in a series of very large but infrequent earthquakes.

The National Earthquake Hazard Reduction Program has funded the Oregon Department of Geology and Mineral Industries (DOGAMI) for a five year study aimed at predicting the local intensity of earthquakes in the Portland area, based on geology. Because it is important to understand the distinction between magnitude of an earthquake and its intensity, we are reprinting the following discussion of earthquake intensity and magnitude from a U.S. Geological Survey pamphlet, *The Severity of an Earthquake.* Copies of this pamphlet may be obtained free from the Book and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 2545, Denver, CO 80225.

The severity of an earthquake can be expressed in terms of both intensity and magnitude. However, the two terms are quite different, and they are often confused by the public.

Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. It varies from place to place within the disturbed region depending on the location of the observer with respect to the earthquake epicenter.

Magnitude is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of the earthquake waves recorded on instruments that have a common calibration. The magnitude of an earthquake is thus represented by a single, instrumentally determined value.

Earthquakes are the result of forces (deep within the Earth's interior) that continuously affect the surface of the Earth. The energy from these forces is stored in a variety of ways within the rocks. When energy is released suddenly, for example by shearing movements along faults in the crust of the Earth, an earthquake results. The area of the fault where the sudden repture takes place is called the Focus or hypocenter of the earthquake. The point on the Earth's surface directly above the focus is called the epicenter of the earthquake.

THE RICHTER MAGNITUDE SCALE

Seismic waves are vibrations from earthquakes that travel through the Earth; they are recorded on instruments called seismographs. Seismographs record a zigzag trace that shows the varying amplitude of ground oscillations beneath the instrument. Sensitive seismographs, which greatly magnify these ground motions, can detect strong earthquakes from sources anywhere in the world. The time, location, and magnitude of an earthquake can be determined from the data recorded by the seismograph stations.

The Richter magnitude scale developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included in the magnitude formula to compensate for variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude of 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value

At first, the Richter Scale could be applied only to the records from instruments of identical manufacture. Now, instruments are carefully calibrated with respect to each other. Thus, magnitude can be computed from the record of any calibrated seismograph.

Earthquakes with a magnitude of 2.0 or less are usually called microearthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of about 4.5 or greater--- there are several thousand such shocks annually---are strong enough to be recorded by sensitive seismographs all over the world. Great earthquakes, such as the 1906 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On the average, one earthquake of such size occurs somewhere in the world each year. Although the Richter Scale has no upper limit, the largest known shocks have had magnitudes in the 8.8 to 8.9 range. Recently another scale called the movement magnitude scale has been devised for more precise study of great earthquakes.

The Richter Scale is not used to express damage. An earthquake in a densely populated area that results in many deaths and considerable damage may have the same magnitude as a shock in a large remote area that does nothing more than frighten the wildlife. Large-magnitude earthquakes that occur beneath the oceans may not even be felt by humans.

THE MODIFIED MERCALLI INTENSITY SCALE

The effect of an earthquake on the Earth's surface is called intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and, finally, total destruction. Although numerous intensity scales have been developed over the last several years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed on 1931 by the American seismologists Harry Wood and Frank Neumann. This scale is composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead, it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity Scale value assigned to a specific site after an earthquake provides a measure of severity that is more meaningful to the nonscientists than magnitude, because intensity refers to the effects actually experienced at that place. After the occurrence of a widely felt earthquake, the Geological Survey mails questionnaires to postmasters for distribution in the distrubed area, requesting information so that intensity volumes can be assigned. The results of this postal canvass and information furnished by other sources are used to assign an intensity value and to compile isoseismal maps that show the extent of various levels of intensity within the area where the earthquake was felt. The maximum observed intensity generally occurs near the epicenter.

The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity value of VIII or above.

The following is an abbreviated description of the 12 levels of Modified Mercalli intensity.

I. Not felt except by a very few, under especially favorable conditions.

II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicate suspended objects may swing.

III. Felt noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.

!V. Felt indoors by many, outdoors by a few during the day. At night , some awakened. Dishes, windows, doors disturbed; walls make cracking sounds. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.

VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings, with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

X. Some well built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rail bent greatly.

XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Another measure of the relative strength of an earthquake is the size of the area over which the shaking is noticed. This measure has particularly useful in estimating the relative severity of historic shocks that were not recorded by seismographs or did not occur in populated areas. The extent of the associated areas where effects were felt indicates that some comparatively large earthquakes have occurred in the past in places not considered by the general public to be regions of major earthquake activity. For example, the three shocks in 1811 and 1812 near Madrid, Missouri, were felt over the entire eastern United States. Because there were so few people in the area west of New Madrid, it is not known how far the shocks were felt in that direction. The 1886 earthquake at Charleston, South Carolina, was also felt over a region of about 2 million square miles, which includes most of eastern United States.⊕

The article *The Severity of an Earthquake* was published by the U.S. Geological Survey and then was reprinted in Oregon Geology, Volume 51, Number 1, January 1989

PUNY PATHS TO THE SEA AT MERCY OF GEOLOGY

What made the lay of the land what it is also means change is inevitable----even ongoing.

By Kym Pokorny of the Oregonian staff.

As they detour around the beleaguered Arch Cape tunnel, day-trippers and irritated coastal commuters have an extra 45 minutes to appreciate the mind-bending forces that formed it.

The U.S. 101 tunnel, now closed for more than a week, bore through two types of rock that characterize the northern Oregon coast: the soft sedimentary rock that forms the coast's bays and the hard basalt that punches up every so often in rugged headlands such as Arch Cape.

It's hard to wrap the human mind around history so old, but before human beings walked the Earth, dramatic forces were shaping majestic Yaquina Head and the sweeping sands of Tillamook Bay.

Fifteen to 18 million years ago, the basalt that shapes such north coast landmarks as Arch Cape, Seal Rocks and Tillamook Head was hot lava flowing down the Columbia River corridor. The 50,000 cubic miles of lava was wide enough to create a wall a mile wide and two miles high extending around the entire world.

The lava poured out of cracks in the earth as long ε 100 miles and as far east as Idaho and moved across the Columbia Plateau 300 to 400 miles to the sea, explained William Orr, professor of geologic science at the University of Oregon and co-author of two books of the geology of Oregon and the Northwest. The lava flowed down the Columbia River corridor, some spreading as far south as Salem, some oozing to the mouth of the river.

As it met the ocean, the lava, steaming and mixing with salt-water , formed huge spoon-shaped pools of lava. The ponds, tremendously heavy, began to invade the soft sedimentary material on the ocean floor and eventually punched up from below to resurface all along the northern coast, forming hard headlands we see today with soft sedimentary bays in between.

At the same time as all these special effects were taking place, other forces were at work. Two plates of the earth's crust were colliding (still are, actually). The North American Plate moves westward while the eastward-moving Juan de Fuca plate gets shoved underneath.

Orr describes it as like sweeping dust under a rug. "If you're a really a bad housekeeper, pretty soon you do it enough, and you see a bump under the rug. In thi case, the bump is the Coast Range.

That "ramming and jamming" is still going on, Orr said making the Oregon coast an active geological area. The coastline rises as the plates slide against each other. When these plates slip, an earthquake shakes up the status quo.

As the coast rises, flat surfaces that once were part of the ocean floor come into view. The flat areas form a whole series of stair-step terraces. Towns were built on terraces and Orr says almost all of U.S. 101 runs along one.

To the untrained eye, Oregon's south coast looks about the same as the north: rugged headlands interspersed with sandy bays. Indeed, thre entire coast is formed of sedimentary rock "bejeweled with volcanic rock," Orr said. But the volcanic rock of the south spewed up out of volcanoes on the ocean floor to form such as Cape Arago, and Cape Blanco.

Obviously, a lot more is going on along the coast than bumper boats and kite flying. Underneath your feet or flippers, forces take the coast to new heights. Rain and wind and ravaging waves beat the volcanic basalt rocks that once were lava flows in Eastern Oregon. Someday the face of the Oregon coast will have new wrinkles, and the old features will sag or be lifted by forces human being can't control. But we'll be long gone by then, no longer fretting about tunnels and highways and our puny paths to the sea.

Permission was granted by The Oregonian to print the article .

CORRECT DEFINITIONS OF COMPLETELY FRACTURED GEOLOGY

adapted from Dictionary of Geological Terms, ed. by Bates & Jackson for AGI, 1984. E. Pratt.

1. **fluvial:** pertaining to rivers; produced by the action a stream or river; living in a river.
2. **emergent**: the rising up or coming into view of land formerly under water.
3. **downdip block**: in a fault, the rocks on the side that appears to have moved downward.
4. **declination**: in any given location, the horizontal angle between true north and magnetic north.
5. **crossed nicols**: in a polarizing microscope, two Nicol prisms (Polaroid plates) that are turned so that planes of polarized light are transmitted at right angles to each other.
6. **collimate**: to bring into line, as the axes of two lense or two telescopes; to make parallel, as refracted or reflected rays.
7. **laterite**: highly weathered red soil which develops in the tropics or in warm forested climates; rich in oxides of iron and aluminum.
8. **littoral**: pertaining to the intertidal zone.
9. **pelagic**: pertaining to the open ocean or to the deeper part of a lake (10 m+).
10. **rutilated**: refers to a titanium oxide mineral which forms prism- or needle-shaped crystals in other minerals.

CHANGE OF ADDRESS

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NEW VOLCANIC HAZARDS VIDEOTAPE RELEASED

A new videotape, "Understanding Volcanic Hazards", is now available from the Northwest Interpretive Association(NWIA). The video tape features stunning images of seven types of volcanic hazards: ash falls, hot ash flows, mudflows, landslides, volcanic tsunamis, lava flows, and volcanic gases.

The videa was produced by the late Maurice Kraft, who was killed, along with his wife Katia and Washington geologist Harry Glicken, by a hot ash flow while filming at Unsen Volcano in Japan in 1991. Sponsered by the International Association of Volcanology and Chemistry of the Earth' Interior (IACVCEI) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), this program is intended to help prevent future deaths from volcanic eruptions by showing compelling images of destructive volcani activity.

The Northwest Interpretive Association (NWIA) a non-profit organization that sells products related to the natural history of the Pacific Northwest's National Forests and Parks, is distributing the video for IAVCEI. Orders can be placed by mail with an enclosed check or by phone with a VISA card number.

Cost of the tape is $19.95 plus postage. Add $5.00 for postage in United States, Canada and Mexico. As the video comes in English and Spanish versions, specify the version you want. Allow about 2-4 weeks for delivery. To place your order:

Northwest Interpretive Association(NWIA)
3029 Spirit Lake Highway
Castle Rock, WA 98611
Phone: 360-274-2125.

"GEO FACTS"

FACT: Mount Rainier's 156 billion cubic feet of glacial ice id greater than the combined volume of all the ice on all other volcanoes in Wasahington, Orego and California. If melted, it would fill Lake Washington

NORTHWEST "RIGS"
or
REGIONALLY IMPORTANT GEOLOGICAL SITES

A few days ago I came upon a series of articles in the British magazine "Geology" that discussed their growing concern with natural sites that contain important social and areal values for scientific, teaching, aesthetic, historical or cultural uses. Sites were also rated according to their areal value from local to county, regional, national and international.

It seems that as long ago as 1949, certain standards were proposed by a "Nature Conservancy Council" (NCC). In 1977 a "National Scheme for Geological Site Determination" (NSGSD) was published, and in 1990 the values for "Regionally Important Geological Sites" (RIGS) were outlined, apparently taken in part from international standards under the acronym of SSSI, the meaning of which was not given in the articles.

It occurred to me that it would be an interesting exercise to examine and rate Northwest geological sites by these criteria. If we give 1 to 10 points to a site for it's areal importance (local 2 to international 10), we can then rate the sites from 1 to 10 for each of the five social values.

Area	Site	Sci.	Teach.	Asthet.	Hist.	Cult.	Total
10	Crater Lake	8	6	10	3	6	43
9	Columbia River Gorge	9	8	9	6	8	49
6	Table Rocks	6	6	7	4	4	33
8	Scablands	9	9	7	5	5	43
6	Paulina Caldera	8	8	8	4	3	37
4	Klamath Graben	6	6	6	3	3	28

How about making this a GSOC effort, with possible publication in "Oregon Geology"? Please do make some comment.

If you disagree with any of my ratings above, please change them and pass it on through the buck sheet process. I will add those you suggesst to the list above and give you all copies.

John Eliot Allen
16 May 1995

DEC 95

THE GEOLOGICAL NEWSLETTER

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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VOL. 61, No.12
DECEMBER, 1995

DECEMBER ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Lunch with members in cafeteria at 11:30 AM, if desired)

Dec. 1: Scenic Oregon and a Rock Factory
Mel Anderson, professional photographer

Dec. 15: Iceland
Helen Nelson, GSOC member

FRIDAY EVENING MEETINGS: 8:00 pm Portland State University, Cramer Hall, Rm. 371

Dec. 8: Science in the Media
Richard Hill, Science Editor, The Oregonian

Dec. 22: Christmas Holiday - no program

GEOLOGY SEMINAR: 8:00 PM. Portland State Univ., Cramer Hall, Rm. S-17

Dec. 20: Basin and Range Seminar leader: Donald Botteron. Please read Ch. 4, pp. 79-101 in Orr, Orr & Baldwin's Geology of Oregon, 4th Ed., before coming to seminar.

DUES ARE DUE! DUES ARE DUE! DUES ARE DUE!

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH. Write or call Evelyn Pratt, 223-2601.

NOMINATING COMMITTEE FOR GSOC OFFICERS FOR 1996

CHAIRMAN : **Paul Brown**

Clara Batholomay
Don Barr
John Bonebrake
Kenneth Yost

THE NOMINATING COMMITTEE HAS PROPOSED THE FOLLOWING MEMBERS AS GSOC OFFICERS FOR 1996 TERM. ALL HAVE AGREED TO TAKE THEIR RESPECTIVE OFFICES.

PRESIDENT: Richard Bartels
VICE PRESIDENT: Paul Brown
SECRETARY:------------
TREASURER: Phyllis Thorne
DIRECTOR: Ray Crowe

COMPLETELY FRACTURED GEOLOGY
by the Pratt/Pearson/Murray families

1. peridotite: term for individual who has imbibed an excess of peridot wine.
2. kimberlite: low-calorie product of Kimber Micro-Brewery.
3. laminar: one who seals documents in plastic.
4. lapilli: ornaments for the lapels of men's suit coats.
5. meander: the objective case of I + she.
6. orogenic belt: in fairy tales, a magic belt made of gold.
7. remanent magnetization: refers to a method of removing scraps of iron from the stomachs of cows and sheep.
8. playa: in Sweden, a fake affirmative vote.
9. Liesegang rings: in groups of German street youths, signs of betrothal.
10. craton: a small square of toast added to soup or salad.

EARTHQUAKE PREPAREDNESS-----WHEN YOUR NOT AT HOME

by Gerald W.Thorsen, 1926 Lincoln Street, Port Townsend, WA 98368

The small earthquakes of June 1994 in western Washington are another reminder that we live in earthquake country. Most of us have received some training and advice about what to do in our homes and offices. But many of us travel to the mountains and beaches for weekends and vacations, and many tourists come to see Washington's Cascades and Olympic ranges and or coast.

Our playgrounds offer potential earthquake hazards that differ from those at home and in the workplace. When a major earthquake hits, thousands of people will share the 'ride', but many will be exposed to hazards unlike those they may have prepared for an that are unique to their setting as of that moment. The fact they don't need to worry about falling bricks and glass or other hazards of civilization doesn't mean that we just clean up the mess and continue the picnic. In indoor settings in our technically active state, ground shaking itself will likely be our only warning to quickly assess the situation. We can't expect a loudspeaker--equipped helicopter to tell us what to do.

If you experienced shaking so strong that it was difficult to stand, it was a major earthquake, and you should expect some major events to follow. Depending on your location some may occur before the shaking stops, and other hazards may take hours to develop. This article suggests some hazards to be aware of and offers some ways to avoid or cope with them, just in case.

COASTAL LOCATIONS

A serious potential hazard for the ocean coasts is se waves (sometime gigantic) termed tsunamis. Triggering mechanisms for tsunamis are massive submarine landslides on the continental slope, abrupt vertical motion of the continental shelf, or both. The resulting wave action on the coast would be unpredictable. The first arrival might be as a trough, with the sea receding far offshore and 'out' for possibly 10 minutes or more. Furthermore, the first tsunami is not necessarily the largest, and subsequent waves may arrive many minutes after the first. On the open coast there might not even be a wave, just a rapid rising 'tide' that keeps rising and rising!

Unlike the tsunami that hit our coast about 3.5 hours after the 1964 Alaska earthquake, a tsunami originating along the Pacific coast of Washington could reach the beaches in minutes.

Tsunamis can also travel considerable distances up coastal rivers and estuaries, and they commonly increase in height in these places because the same volume of water is moving in a narrower space as they progress upstream. Almost all the damage from 1964 tsunamis in the Pacific Northwest were along such inlets.

There are sedimentary records consisting of telltale layers left by geologically recent tsunamis in several estuaries on the Pacific Coast, so that we know that these areas have been subjected to such waves in the past (Atwater and Yamaguchi, 1991). Depositional patterns also record at least one tsunami in Puget Sound.

Tsunamis can be extremely powerful and destructive. Possibly the most dangerous part of the tsunami is the debris carried along with the rushing water---driftwood, parts of buildings, rail cars, boats, literally anything moveable will batter everything in the wave path. The bridge across the Copalis River was badly damaged in 1964 by logs hurled against the pilings, and much of the destruction of coastal towns of Washington and Oregon was caused by floating debris. (One of the few injured along the Washington's coast in 1964 was a motorist who drove off a tsunami-damaged bridge).

Tsunami waves generated in the Pacific Ocean would diminish as they travel along the Strait of Juan de Fuca and narrower inlets. They might be insignificant in Hood Canal or along the shores ofPuget Sound. Also , the camper, clam digger, or hiker along such inland shorelines will have more time to get to higher ground than those along ocean beaches. However, because it is not immediately possible to tell where an earthquake originated or where a local wave-causing event might occur, you should get ready to leave low ground as soon as possible after any warning, even along inland shorelines.

The potential for dangerous waves to originate in inland waters comes from a variety of sources. The tsunami recorded in tidal marsh sediments at West Point in Seattle and Cultus Bay on Whidbey Island probably was caused by abrupt vertical movement of the floor of Puget Sound between Alki Point and Bainbridge Island (Atwater and Moore, 1992). Such waves can also be caused by quake-triggered submarine landslides, most commonly on the relatively steep slopes of loose, saturated sediments that make up the delta fronts. Slides on deltas may even include portions of the adjacent shore or uplands. Backfill waves, water that rushes to fill the void left by the drop of the head of the slide, may reach the adjacent shore in seconds. A far-shore wave from such an event can be nearly as damaging. In these , too, there is very little time to move safely away from the shore.

SAFETY SUGGESTIONS

If you are at an ocean beach and you feel strong ground motion or you notice a sudden change of the sea (at night the sound of the surf might abruptly cease) immediately begin to prepare for a calm but quick retreat to higher ground. Time spent hooking up a trailer or folding a tent could, in some , areas might mean being farther back in a traffic jam. Some bridges across coastal rivers are in locations vulnerable to tsunamis and you should try to avoid routes across these bridges if you need to leave the coast or river banks.

You can plan ahead for safety while you'r at the beach by getting familiar with the area. Find possible evacuation routes and locate higher ground you can reach in a matter of minutes. Whether evacuating in response to local strong shaking or in response to official warnings of a tsunami from distant quakes, do not return to the beach or low-lying area until you have official work that it is safe to do so.

Never wait along the beach or shoreline estuary to watch a tsunami come ashore. These waves are much much faster than you can run or drive, and runup elevations are unpredictable.

MOUNTAINOUS LOCATIONS

Campers and hikers in a mountain valley may face a different, but no less urgent problems after an earthquake, Many of these situations were illustrated by events during and following the 1959 Hebgen Lake earthquake, which was centered north of Yellowstone Park. Rockslides buried some campgrounds, and rolling boulders damaged other sites. Along one lake, segments of the shoreline were repeatedly flooded by the to-and-fro sloshing of the lake water (waves called seiches).

A landslide into a lake can also cause violent wave action. For example, the 1946 Vancouver Island quake triggered a slide that generated an 80-foot wave on one lake there. The prehistoric landslide that separated the single ancestral lake into Lakes Sutherland and Crescent on the north side of the Olympic Peninsula (Tabor, 1987) no doubt created similar havoc.

Landslide dams commonly result from major earthquakes. Drainages can be blocked by rock and debris that collapse into narrow valleys from adjacent slopes The Hamma Hamma River, in the eastern Olympic Mountains, was blocked in prehistoric times by a landslide that may have been quake-triggered (Schuster and others, 1992). The 1959 Hebgen Lake earthquake triggered a very large landslide that dammed the Madison River, and campers had to flee the rapidly rising backed-up water.

If you are camped near a stream and, after experiencing a quake, you notice significant changes in its flow, slide damming has almost certainly occurred. Flooding above such a landslide dam may be relatively slow and is seldom as dangerous as the sudden downstream flooding that occurs if (or, more properly), when such a dam is overtopped or breached. Dam-break floods can cause devastation for mile downstream.

SAFETY SUGGESTIONS

If you feel an earthquake when in the mountains, your urge to flee the area must be tempered with an assessment of you particular situation. What are the current and potential hazards where you are? Could they be worse at your destination or along the way? For example, one family , fleeing in the dark after the Hebgen Lake quake, drove off a slide scarp that had cut the highway. (They were able to walk back to their motel). Whether you are on a mountain logging road or U.S. Highway 101, car travel after a major earthquake will require caution.. Sections of road may be gone or covered by slides and boulders. Aftershocks could bring more of the same, possibly trapping travelers in a worse location than that from which they fled.

Are the bridges safe? Some bridges may ride out a quake undamaged, but spreading and settlement of adjacent fills may leave concrete walls or 'launching ramps' at either approach. Don't assume that highway crews have been able to reach the area and place warnings! They will have plenty of problems, and yours will be of low priority compared to those in and near population centers.

GENERAL SAFETY PREPARATIONS

Some of the best preparation for an earthquake in coastal or mountainous areas is in your head---you will never know where you will be when one happens. Review emergency plans with your companions when you get to your recreation destination. Especially for children, this can be an exercise in natural history, like the local geology, plants, and animals. Remember , no one has ever been shaken to death by an earthquake---it is the side-effects of the shaking that you need to be concerned about.

Bring along some emergency supplies and leave some in your vehicle: first aid equipment, food, ˇater, and warm clothing, battery-operated radio ..ıd flashlights. And if you have one along, a bicycle can be useful for getting past damaged sections of road or fallen trees. Monitor your car or portable radio to get information, but don't expect much the first day. Plan on being on your own for as long as three days.

A better understanding of what happens during earthquakes and awareness of what might happen next in any setting can go a long way toward dispelling irrational fears or avoiding spoiling your trip.

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Earthquake Preparedness--When You're Not at Home was printed in Washington Geology, vol. 22, no. 3, September 1994, p 35-38.

******** Due to space limitation pictures with this article have been left out.⊗

CORRECT DEFINITIONS adapted from Dictionary of Geological Terms, ed. by Bates & Jackson for AGI, 1984. E. Pratt.

1. peridotite: a coarse-grained igneous rock formed at great depth and composed mainly of olivine.
2. kimberlite: a peridotite containing many crystals of olivine and magnesium-rich mica; in South Africa, a good place to look for diamonds.
3. laminar: arranged in very thin layers, such as alternate layers of different sediments.
4. lapilli: rocks 2 to 64 mm erupted and thrown out of a volcano (cinders & a bit more).
5. meander: one of a series of S-curves in a mature stream.
6. orogenic belt: a long or arc-shaped region that has been folded and deformed during mountain-building.
7. remanent magnetization: that part of a rock's magnetization that has a fixed direction and can't be moved by moderate magnetic fields such as the earth's magnetic field.
8. playa: a dry, barren area in the lowest part of an undrained desert basin; when there have been heavy rains, a lake may form in it.
9. Liesegang rings: secondary, nested rings or bands caused by rhythmic precipitation within a fluid-saturated rock.
10. craton: that part of a continent which has been stable and little deformed for a long time.

GOLD IN OREGON

by Rosemary Kenney, GSOC

Gold appears in streams all around the state. In all but a few cases there is too little of it to support a profitable mining operation. Most of the gold found in Oregon's streams occurs as small fine flecks. Larger particles, called coarse gold, are less common. Rarer still are gold nuggets. The laargest nugget ever discovered in Oregon weighs over five pounds. It was found in Baker County and is on display at the Baker City branch of U.S.Bank.

Southwest Oregon is the second biggest producing area in Oregon. The Western Cascades rank third. In 1933, about 2,021 ounces worth $788,000 were recovered in the state. Within less than an hour's drive of the State Capital, there are productive gold claims in Marion County. Gold is also found in the Coast Range, North-Central Oregon and in the southeast.

This article is an excerpt from *Geology Update*, Spring, 1995, Vol. 1.4, a publication of DOGAMI

FIRST AMERICAN ROCKHOUNDS

by Ivan Imel, The Rockytier 6/93

We try to imagine when rockhounding first became popular - 30s', 40s',50s'...or when. We know it peaked in the 50s' and 60s', the golden age.

What we didn't realize that rockhounding began a lot longer ago that the early 20th century, thousands of years, in fact. What is currently thought to be the first American, Clovis hunters wandered across the Bering Straits to become our first rockhounds approximately 11,000 years ago. Their first points, the ones they brought with them, may have been bone, ivory or struck flint blades. Somewhere in the USA they developed their characteristic leaf-shaped point with large thinning scars prominent in the base and running one third to one half of the length of the point. These points are among the finest points made by American Indian hunters.

We conjure up pictures of Clovis hunters killing mammoth, but the truth is they hunted anything that moved and had any size at all, down to rabbits ar armadillos. Where did the rockhounding come in. Clovis hunters prized the best flints, cherts, petrified wood, agates, chalcedonies, obsidian and jaspers they could lay lands on. Think of the oppotunities they had as they were the first to find nearly every major occurrence of fine material and they were willing to haul these materials away as blanks and tools for hundreds and possibly a thousand miles or more.

A Clovis point found near Uvalde, Texas, was made of obsidian from 125 miles north of Mexico City. Another obsidian Clovis point found at Blackwater Draw came from the Mineral Range in Utah. Two Clovis points or knives found near St. Louis were of Knife River flint a silicifed lignite, with rich translucent amber colors. From the same cache was one point of famous Knife Ridge flint (Ohio) and a fluted knife of Indiana hornstone, both a considerable distance source.

At Wenatchee, Washington, a cache of incredibly beautiful Clovis blades and points were made of agate varieties from nearby source. Th points were dendritic chalcedony, banded agate, an a large Clovis blade found nearby of obsidian. They were the first to exploit this agate souce, but not the last, being quarried up until late prehistoric times. A number of agate points were found in Utah and Nevada.

Probably the most striking Clovis blade, 12 inches by 3 inches, was found near an old lake in northern Mexico and made of beautiful red banded Laguna agate

A clovis point found near Dickens, Texas, is made of beautiful variegated Tecouas jasper in yellow, reds, and pinks

The list of beautiful materials would go on and on. The fact is Clovis hunters had an eye for beautiful rock and were willing to go where roads didn't go. In their spread across the lower 48 states, much of Canada, Mecico, Guatemala, Costa Rica, and possibly clear down to Venenezueka, they had an eye for beauty combined with wanderlust, all the makings of a first class rockhound.⊗

This article taken from *NORTHWE NEWSLETTER*, Vol.XXXIV - July 1995